news, knowledge, advice

SCIENCE DIGEST

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IS THIS A SEA MONSTER ?

see page 16

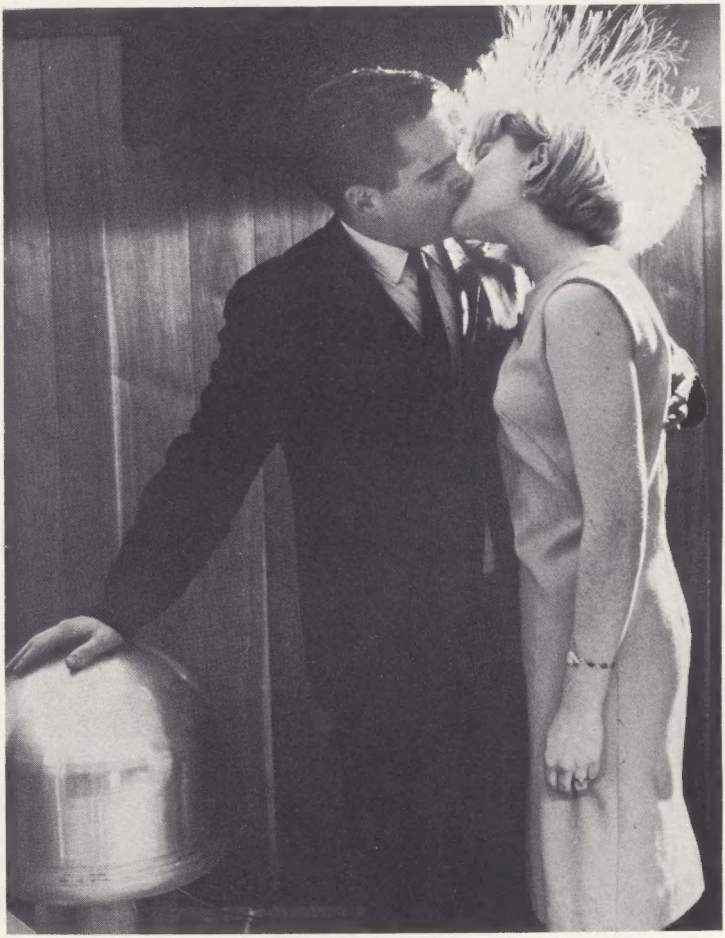
AN MD PRESCRIBES FOR ULCERS

Laser: miracle ray grows up

SPECIAL:

NEW ERA FOR ASTRONOMY

Strange worlds, new mysteries in space



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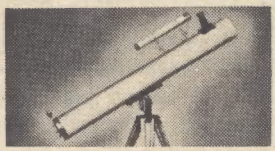

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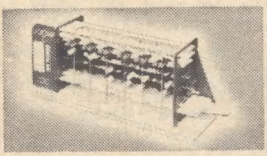

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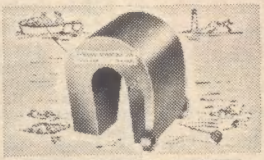

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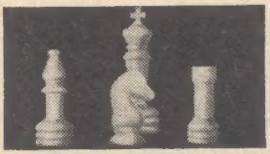

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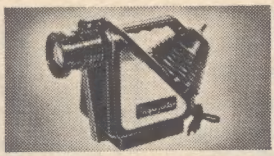

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ABOMINABLE snow men, giant sea serpents, prehistoric monsters and other such creatures, have been reported by adventurous travelers in far off places since the beginnings of recorded history. Few globe-trotters have managed to exhibit the imagination of Ulysses—whose cyclops, unicorns, sirens and the like probably set the format for the whole business. But lots of them have come close.

What's more interesting, however, is the fact that in a number of re-

THIS MONTH

cent cases, enough evidence of the existence of a "monster" has been brought back to provide scientists with strong suspicion—if not proof—of its probable existence.

Daniel Cohen, *Science Digest's* managing editor (and "curator of monster stories"), has rounded up a variety of the most famous monster legends, reports and outright frauds. He has taken each in turn and examined the available evidence. You'll find his fascinating report on page 14—along with the answer to the question posed on this month's cover beside the remarkable photograph of a long-tailed "sea something." The man who took that shot says he saw the creature kicking up the water off Australia's coast. A crew member got in the dinghy, and this picture resulted. Is it genuine? Turn to page 16 and find out.

—THE EDITOR

news, knowledge, advice

SCIENCE

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DIGEST

Do sea monsters really exist? The one on this month's cover was allegedly photographed by a yachtsman off the coast of Australia. But what about other monsters—the abominable snowman of Nepal, the giant sloth of Patagonia, the monkey man of Venezuela? See page 14.

Pictorial Parade photo

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Is This The Answer To Einstein's Quest For A Unified Field Theory?

Einstein spent his later years in searching for an all-encompassing theory that would include his Theory of General Relativity and his Theory of Special Relativity, a theory that would link the phenomena of Gravity, Magnetism and Electrostatics into one indisputable general law.

A solution to Einstein's quest is offered in a provocative, interesting 64 page book, "Unification of the Fields of Gravity, Magnetism and Electrostatics Using a Law of Relative Motion," in which the author traces the search for a common law from its origins with Galileo, through the initial calculation of the speed of light by Roemer, the famous Michelson-Morley experiment and on to Einstein's almost successful search to unravel the mysteries of the Universe. The book is written in a clear, concise, lucid style and will prove to be absorbing reading to the scientifically trained mind and to the layman alike. It will enable the reader to gain a clearer understanding of Relativity and of the Universe in which we live.

The book opens new avenues of thought about the basic laws that govern the Universe—suggests new applications of known phenomena—and lays to rest the antiquated understructure of much of today's concepts concerning the components of our Universe. Phenomena such as quasars, "red shift," mass and time are examined from a new point of view.

To physicists and others of the scientific community the book offers the challenge of a provocative, new theory worthy of the most probing analysis. To the layman interested in modern trends of scientific thought the book will be a fascinating adventure to the frontiers of science. The limited special edition is now available at only $1 per copy, mailed postpaid.

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Bulletins at press tim

NEW FIND AT GIZA. A new tomb has been unearthed near the pyramid of Chephren, second largest of the three pyramids at Giza. Most important discovery in the tomb was a broken statue (head shown above) of a member of the pharaoh's entourage.

PHARAOHS HAD POOR TEETH. A team of scientists who have been studying the development of poor teeth X-rayed the teeth of 40 Egypt's royal mummies. They found that many had severe gum and tooth troubles and that "buck" teeth also afflicted many of the royal mouths, whereas this condition was rare among the common people of ancient Egypt.

NEW SPECIES FORMED IN LAB. A world famous geneticist Dr. Theodosius Dobzhansky has observed what he believes may be the first step in the formation of a new species of laboratory fruit fly. This is the first time such an event has been observed in higher forms of life in the lab.

DIAMONDS ON THE MOON. A G.E. research team has suggested that there may be diamonds on the surface of the moon. It is considered unlikely, however, that they will be found in large enough quantity to be of commercial importance.

AIR POLLUTION HURTS RUNNERS. The motor-fuel type of air pollution in the Los Angeles area may hamper athletic performance, a report in the Journal of the American Medical Assn. suggests. High school cross-country runners at San Marino, Calif., a Los Angeles suburb, performed poorest at track meets when oxidant air pollution was greatest.

LSD MAY DAMAGE GENES. A New York State University scientist has reported evidence suggesting that LSD can damage the chromosomes. Such chromosomal changes could lead to mental retardation and physical abnormalities in the offspring of LSD users But Dr. Maimon M. Cohen emphasized that the studies are as yet in their preliminary stages.

EMOTIONAL TIE TO DWARFISM. The results of a six-year study of dwarfed children at Johns Hopkins Hospital indicated that psychological factors contributed more to stunting growth than biological ones. The report said that the negative role of the fathers was a major influence on dwarfism.

STUDY SAFETY OF ARTHRITIS DRUG. The Food and Drug Administration is studying the side effects of Indocin, a drug widely used to help relieve arthritis and associated illnesses. Reports have reached the agency that adverse reactions including several deaths had been linked to use of the drug.

CANADIAN TURBO TRAIN. By mid-July the Canadian National Railways expects to have a 120-mph turbo train running between Toronto and Montreal. It will cut at least one hour from the 335 mile trip.

GULF STREAM VESSEL. An undersea vessel that will drift submerged in the Gulf Stream for four to six weeks next summer is being constructed in London. The craft, called PX-15 mesoscaph, is the brain child of Dr. Jacques Piccard. The voyage will give scientists their first chance to observe marine life and phenomena from a silent undersea vantage point for such a long period.

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The miracle ray grows up

Born amid so many predictions and promises, the laser was oversold and almost became a joke. Now after years of work it is fulfilling some of those promises.

by John H. McElroy

In a recent James Bond movie the hero was pinned to a slab of metal in preparation for being vertically bisected by a powerful red laser beam. Laser engineers watched with an air of amused condescension as the beam burned its way through the slab toward his body. Their day-to-day contact with lasers made them certain that such a device was many years in the future.

An indication of the rapid changes now taking place is that the same men seeing the film today would display a very different reaction. They might quibble about the details but they would not question the possibility of setting up a situation in which all of the essential facts would agree with the movie version. This change in attitude is symptomatic of the reassessment of the laser which even those who have worked closely with lasers have had to make recently. The laser is quietly beginning to live up to the grand predictions heard so frequently in the months following its birth.

A development that has given new life to the laser field is the molecular gas laser, the carbon dioxide laser, capable of producing a powerful infrared beam. This laser has demonstrated the capability of producing higher continuous powers (in excess of 1000 watts) at an efficiency more than 100 times greater than any previous gas laser. A laser like this burns through asbestos sheets as if they were tissue paper. When a four-inch thick fire brick is placed in the focused laser beam, the beam burns its way through in three seconds. Granite crumbles before the invisible beam. The carbon dioxide laser has contradicted the belief held by many engineers and scientists that high powers were unattainable with gas lasers.

The announcement of the birth of the laser in 1960 was followed by a sprint of frantic activity. Nearly all major companies related to either the electronics or aerospace industries, as well as many government agencies, began programs to study the laser and its applications. During the succeeding months, the laser received an unprecedented amount of publicity. Inevitably a feeling of disappointment followed. The period of slow, careful development necessary to transform the laser from a laboratory curiosity (a "solution seeking a problem" as it was frequently called) to a working item

When the evil Goldfinger threatened to split James Bond down the middle with a ruby laser, the idea was sheer science fiction. Today it might be possible. The last few years have also seen the development of less nefarious, more practical uses for lasers.

of practical hardware lacked the excitement of the earlier days of the laser. When it was no longer possible to hear of a new breakthrough every day, the laser seemed to lose some of its luster. It is human nature initially to overrate a new scientific development and then, when it proves to be less than miraculous, to judge it too severely. In the following years, laser scientists and engineers have quietly sought applications for the laser. The world of practical application is dominated by the inflexible law of competition. In obedience to that law, laser men must continually pose a single question and seek an affirmative answer. Of all the devices available, can the laser perform a given task faster, better, or more efficiently than any other device? There is now a long list of affirmative answers to that question.

There is some room for argument, but many feel the greatest successes that the laser has had have been in the area of range finding. Laser range finders operate on the principle of sending out a pulse of light and then measuring the time required to travel to a target and return. Laser range finders are so accurate that they have opened a new dimension in the determination of distance. Even well qualified technical people are apt to disbelieve the reports they hear concerning their phenomenal accuracy. Laser range finders can determine the

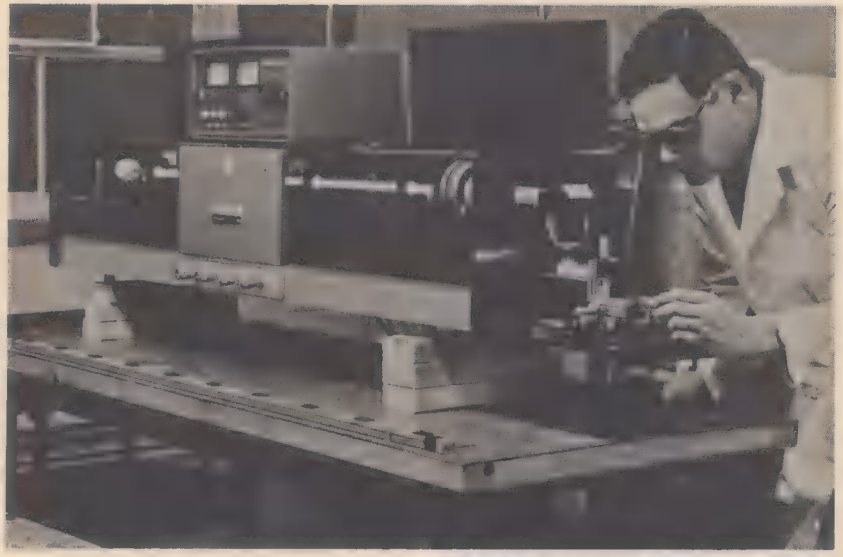
range to a target at distances in excess of 30 miles with a range error of less than 30 inches. In the tracking of satellites which have been equipped with retroreflective mirrors, the results are even better. Laser range finders can measure the distance to such a satellite 100 miles out in space to within 36 inches.

A direct outgrowth of the work with laser range finders is the laser altimeter. A recent experiment demonstrated the unparalleled accuracy of this device. An aircraft equipped with a laser altimeter was flown over a football stadium at an altitude of 1000 feet and at a speed of 250 mph. The laser altimeter was able to record the fact that the cross bars on the goal posts were not quite at regulation height. It further noted that the pitch of the bars was off slightly. Almost the only complaint made by users of laser range finders is that they are simply too accurate for some applications.

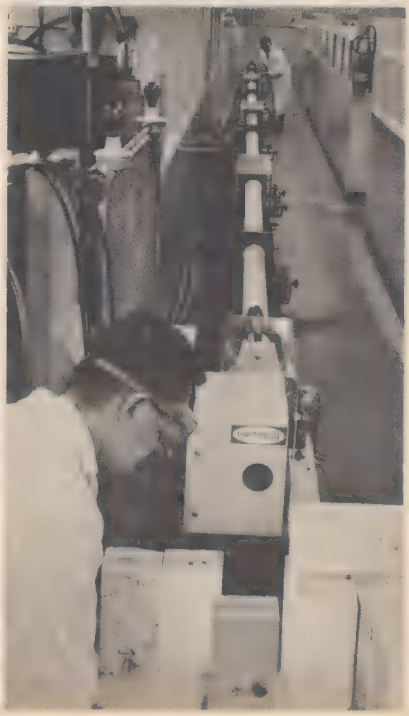
In 1960 the wavelength of the orange-red light emitted by the isotope krypton 86 (Kr^{86}) was named the international standard of length. While the laser shows no immediate promise to displace this wavelength as a primary standard, there are many applications in which the laser is admirably suited to serve as a secondary standard. The use of highly accurate length standards was once confined to the laboratory. Machine shops can now avail themselves of laser interferometers which can be used routinely to make measurements of lengths up to 60 feet with an accuracy greater than 0.00001 inch. At present large aerospace firms such as Boeing use laser techniques for a variety of measurement and calibration problems.

Another application in which the laser is unbeatable is the precision alignment of various devices and systems. The two-mile long linear accelerator at Stanford University presented an intriguing and difficult alignment problem. It was necessary that it be aligned over its entire length to within half a millimeter. The use of a helium-neon laser permits the detection of a misalignment at any one of 274 stations along the accelerator's length to an accuracy twenty times more than required.

Optical equipment manufacturers have found the laser to be an immensely useful tool for the alignment of ultra-precision optical apparatus. Lasers make possible speeds and accuracies which are unapproachable by any other method. The alignment of scientific apparatus is not, however, the only application for the laser's talents in this area. An Oklahoma firm has purchased a laser system to aid in keeping tunnel drilling operations literally "on the beam." In San Francisco Bay a fleet of dredging vessels is kept on station by a number of specially designed laser transits positioned around the bay. The vessels are involved in a night-and-day project to dig a 20,000 foot-long trench across the bay for the Bay Area Rapid Transit Project. A prefabricated tube will be placed in the trench that will eventually carry rapid transit vehicles crammed with



Above: Technician operating medium powered carbon dioxide laser for machining. **Below:** Close up of carbon dioxide laser used for machining; the cutting beam is invisible. **Right:** Ten meter Carbon dioxide laser capable of producing an invisible infrared beam so powerful it will burn its way through any substance known to man.



commuters across the bay. The use of laser transits permits the position of a dredging vessel to be maintained.

Lasers are also being utilized for a wide variety of material processing tasks. Aside from the carbon dioxide laser, other lasers are available which can produce pulses of light so powerful that the air through which they pass is ionized, the air molecules are torn apart by the concentration of energy. In addition the ease with which a laser beam may be controlled gives it an immediate advantage over many other techniques. A successful application of the laser in this area is seen at Western Electric where the laser has solved one of the company's most difficult problems.

Thin copper wire

In modern technology, particularly in the telephone industry, fine and ultra-fine copper wire is indispensable. Western Electric engineers and scientists, in conjunction with Raytheon personnel, used the laser to solve a very persistent problem in the production of fine copper wire. Thin copper wire is produced by taking thicker copper wire and drawing it through a series of dies of gradually decreasing diameter. The dies consist of small discs with a hole drilled through their center. The edges of the hole are rounded so that the hole tapers down to a minimum diameter and then widens again on the opposite side. Therefore, as copper wire is pulled through the die, it is compressed and drawn to a smaller diameter. Because of the high temperatures and pressures involved in the drawing operation, only diamond has been found to be hard enough to be suitable as a material from which to fashion the dies. Yet even a substance as hard as diamond is gradually worn down in the process. In order get the most use out of the expensive dies, it is necessary to resize worn dies so that they may be used as the next larger size. The original drilling, as well as the resizing of worn dies, presented a formidable mechanical problem. Conventional methods required some 24 hours of labor per die. A ruby laser system has been perfected that can perform the job in less than ten minutes.

Shortly after the discovery of the laser there were many predictions regarding the application of the laser to the medical sciences. With the exception of research applications, there has been only one truly successful application of the laser in medicine. Many of the hoped for applications have as yet not materialized. But the single exception is one of the most clear-cut instances where the laser represents a true breakthrough. The retina of the eye is a thin membrane which receives an image formed by the lens of the eye and transmits that image to another membrane called the chorioid. A common ailment which may produce or lead to blindness is the detachment of the retina from the chorioid. Such detachment

The laser may turn out to be the most practical way of communicating with astronauts on other planets.

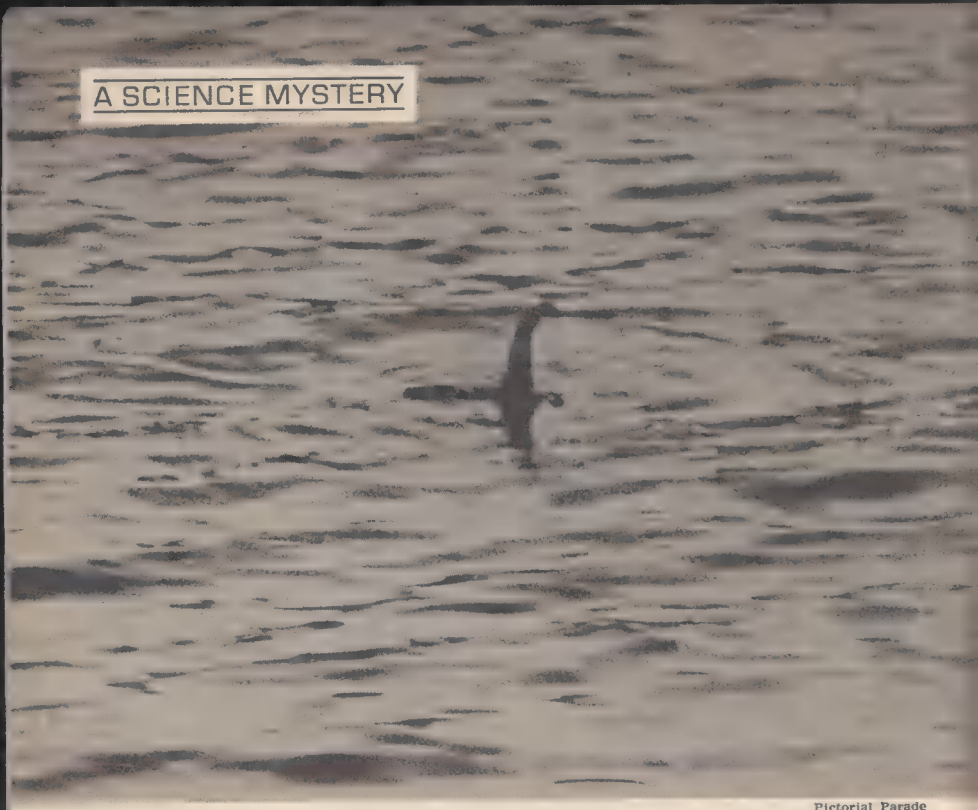
breaks the "circuit" which is responsible for vision. The condition may be corrected by producing in some manner a small amount of scar tissue between the two membranes which acts as a "weld" and recompletes the vision "circuit." In the past, two techniques have been employed. The first involved the use of a diathermy needle. This represents a major operation of several hours duration requiring a general anesthetic and a long, painful recuperation. The laser technique is shorter in duration, does not require a general anesthetic, and requires a shorter recuperation.

In another medical application the laser is replacing another light treatment. This technique involved photocoagulation to produce a small bit of scar tissue. Previously, photocoagulation was produced by the light from a xenon flash lamp similar to the bulb in a photographer's electronic flash unit. Now the same thing is done with a laser. The superiority of the laser photocoagulator comes from the fact that the laser beam can be more precisely positioned, more finely focused, and requires a shorter exposure time.

An application which has not yet achieved reality, but which is receiving increased attention, is the laser deep-space communication system. As man moves deeper and deeper into space, there is serious doubt whether conventional radio-frequency communication systems will be able to meet the severe challenge of interplanetary distances. Recent theoretical studies have shown that the laser may prove to be the most practical way to communicate with Earth from the vicinity of either Mars or Venus. The high frequency of laser radiation makes available great information bandwidths which permit data to be transmitted at very high rates. The laser's high frequency also permits a highly directional beam to be developed by a relatively small physical structure. Conventional radio frequency systems would require an antenna structure many times larger to achieve the same directivity. This may be impossible due to the space and weight limitations which are always present in the design of a spacecraft. Since the directivity of an antenna determines the range which can be obtained at a given power level (by preventing the loss of power through excessive beam spreading), this factor weighs heavily in the laser's favor. For these reasons, it is very possible that the astronauts of the future will send messages from the planets by means of a thin beam of light.

The future of the laser is as bright as the brilliant red flash of light which first leaped from a ruby rod in 1960. Its ultimate utility will be limited only by the imagination of those who employ it.

A SCIENCE MYSTERY



Pictorial Parade

The Loch Ness monster as photographed in 1934. Does the picture show the head and neck of a large animal emerging from the water, or a perfectly ordinary smaller object?

Modern Monsters

(some are real some are not)

by Daniel Cohen

An article of faith among some adventurous naturalists and nature writers is that large and strange animals still remain undiscovered in obscure corners of the world. Accounts of meetings with such monsters are hardy perennials of Sunday supplements and men's magazines.

The most famous of all the fabulous beasts of modern times is the huge and mysterious "monster" of Loch Ness, which has been the subject of so much recent publicity (See *Science Digest*, Jan. '67).

But the Loch Ness monster is only the most well publicized of the fresh water monsters. Tales of similar creatures are attached to many other Scottish and Irish lakes, and

have been for hundreds of years. In Ireland the monsters are sometimes called 'direful wurrms.' In Iceland people talk of the Skrismsl, a fearsome inhabitant of deep lakes. Tales also come from Norway, Sweden, Lake Victoria in Africa and Lake Bikal in the Soviet Union. Next to the Loch Ness monster, the most often authenticated of the fresh water monsters comes from Western Canada. The legends of the Indian population around Lake Okanagn in British Columbia contain a description of a great "water snake" known by the extraordinary name of "Ogopogo." Ogopogo became so popular that at one time *The New York Times* offered $1,000 for a good picture of the beast. So far, no one has had a camera handy when it appeared.

Fresh water lakes are not really the best places for seeing water monsters. Far more spectacular ones have been spotted in the open sea. Some, like the giant squid, have turned out to be real creatures. In other cases the rare oarfish or ribbonfish which grows to a length of twenty feet or more may have accounted for some stories. But there are still plenty of unexplained encounters—and modern ones at that.

The next most illustrious entry in any modern beastiary would have to be the yeti, better known under the handle of "abominable snowman." Now how could any creature, even a mythical one, get such an odd name? No one really seems to know. In 1955 an Indian scholar produced a thorough philological study of the name and concluded that it was a bad translation of two Tibetan words for red bear, and therefore the abominable snowman was nothing more than a bear walking on its hind legs, as they sometimes do. Snowman fanciers were outraged and rushed in with any number of alternative explanations for the origin of the strange name. The origins of the term yeti, another Tibetan word, are also controversial, but since the name is far less cumbersome and confusing it has become popular in recent years.

There have always been stories about strange animals that lived in the remote fastness of the high Himalayas. But the yeti is the one particular creature with really alarming habits that was always a prominent feature of legends of the Himalaya area. It was a huge, hairy, manlike beast, called by many different names. The yeti lived in the mountains and fed on yaks and when yaks became scarce, people.

The beasts were reportedly seen by many natives, and some Western travelers too said they had spotted the yeti or at least its footprints in the snow. Descriptions varied a great deal, and professional zoologists didn't get very excited about the yeti.

In November, 1951, the well-known and highly respected mountaineer, Eric Shipton found a clear trail of enormous and mysterious footprints on the southwestern slopes of Menlung-tse in the Himalayas. Shipton followed the trail for about a mile until it disappeared on hard

Is this a sea monster?

Sad to say, it probably is not. The photograph was taken several years ago by a French photographer off the coast of Australia. It has appeared in many magazines here and in Europe, but it was taken under improbable conditions and even monster enthusiasts have been forced to question the authenticity of the photo. While the photographer was raising money for his trip he, for example, "guaranteed" his backers a genuine "Sea Monster." A rash promise indeed. Says writer Ivan Sanderson, "We serious-minded 'monster-hunters' are just as keen to expose fraud as we are to get sensible reports. This sort of thing puts serious investigation back years and should be exposed."

ice. His photographs of the prints became, and remain, the best single piece of evidence in the case for the yeti. Largely because of them, western mountaineers and a few scientists became serious about the beast. Sir Edmund Hillary, conqueror of Everest, expressed his belief in the yeti, and Tensing Norgay, Hillary's Sherpa guide, who also climbed to the summit of Everest, told of a frightening encounter his father had with one of the creatures. The successful American Everest expedition was about evenly divided into pro- and anti-yeti factions.

Several expeditions set out with the specific purpose of finding a yeti. They didn't see one, but they did look at some odd conical-shaped fur pieces, said to be yeti scalps, which were kept in some of the local temples.

In 1958 a Soviet scientist, Dr. Alexander G. Pronin, created quite a stir when he announced that he had actually seen one of the creatures in the Pamir mountains, a long way from the Himalayas. Many of his colleagues, however, openly hinted that he did not know what he was talking about.

But stories continued to pile up. They even began filtering out of China. The yeti had become big news and the government of Nepal began charging a stiff entry fee for any yeti-chasing expeditions. The government also strictly forbade anyone to kill a yeti except in self defense. The prohibition proved quite unnecessary; none of the yeti hunters got close enough.

U.P.I.

Sir Edmund Hillary and artists conception of abominable snowman, shortly before Sir Edmund's yeti chasing expedition of 1960.

U.P.I.

One of the yeti footprints photographed by Eric Shipton in the Himalayas. Print is compared in size to head of ice ax.

Stories of mountain-dwelling, apelike creatures are not limited to Asia. Legends and stories of similar creatures come from every continent, except Australia and Antarctica. Outside the Himalayas the best stories, surprisingly enough, come from Canada and northern California. At least one expedition set off into the northern California wilderness with the confident hope of bringing back some sort of abominable snowman. They brought back nothing.

Numerous explanations have been offered of what type of creature the yeti might be. The most enthusiastically accepted theory, and the most sensational, is that the yeti is some sort of gigantic subhuman, perhaps one of our very own ancestors who, eons ago, escaped extinction by retreating into the inaccessible mountains. French biologist Bernard Heuvelmans was convinced of this and went so far as to give the yeti a scientific name, *Dinanthropides nivalis*, "terrible anthropoid of the snows." He admitted, however, the creature didn't really live in the snow, because there is nothing to eat up there. Rather it lived in the high forests, just below the timber line, and occasionally ventured into the snows above, where it was more easily seen.

In 1960 the first really large, well-equipped, well-financed and enormously well-publicized expedition set out for Nepal to find the yeti. Leader of the expedition was Sir Edmund Hillary himself, a man who could not be dismissed as a stuffy professor or confirmed skeptic.

Sir Edmund was able to do more than photograph and examine the yeti "scalps." He was able to bring one back for closer study. When the experts got a look at it they found it was a man-made object, shaped from the pelt of a common goat-like animal. It was an interesting fur cap, but not much else. So one of the best pieces of physical evidence for the yeti dissolved.

There remain the yeti tracks. But tracks alone are not conclusive, no matter how odd or large they may look. In snow, the footprints of well-known animals can assume un-

familiar shapes and sizes. The snow can melt a bit thus blurring and enlarging footprints. Animals may put back feet in prints of the front feet to avoid breaking fresh snow. Sir Edmund expressed the opinion that some of the yeti prints could have been produced by a line of foxes "stringing," that is, all jumping in the footprints made by the leader of the line. Melting could have obscured the outlines of individual feet and left the impression of a single animal with large feet.

Photos can lie

The stories remain; possibly they mean a great deal, possibly not.

One would think that a good, clear, close photograph of an unknown animal would quickly solve all problems. But in the case of the Venezuelan ape man things turned out quite differently.

South America is filled with monkeys, but there are no apes, nor any evidence that there ever were apes there. In June 1929 the *Illustrated London News* published an article headed "A Gap Filled in the Pedigree of Man." The article was written by a Swiss oil geologist Francois de Loys and concerned a large ape he had met and killed some years before while exploring the Venezuelan wilderness. He said he had photographic proof of his adventure.

After killing the five-foot-high tailless ape, de Loys sat the dead animal on a small carton, propping it up with a long stick under its jaw, and took a photograph. He then skinned the creature, put the skin in one box and the skull in another box. A short time afterwards the expedition was attacked by Indians and both boxes were lost. When de Loys returned from the jungle all he had left was the photograph.

The French anthropologist, Georges Montandon, was enthusiastic about the photograph, however, and wrote a paper in which he named the creature *Ameranthropoides loysi,* "de Loys' manlike American ape." But when he read his paper to the Paris Academy of Science they gave it a cold reception. *Ameranthropoides loysi,* they pointed out, looked just exactly like the common South American spider monkey. True, the spider monkey has a long tail and de Loys' ape was supposed to have none. But the taillessness of the creature would have to be accepted on faith. For in the photo the animal is facing the camera and the tail could easily be concealed behind the box on which it is seated. Or the member may have been amputated. There are no five-foot spider monkeys, but the size of de Loys creature would also have to be taken on faith, for the picture contains no object against which its size can be accurately compared.

Ultimately the photo proved nothing. What the argument came down to was that the scientists would have to take de Loys' word that he came upon an entirely unknown animal that looked very much like a spider monkey—but wasn't.

American Museum of Natural History

Bones of the giant sloth (left) and giant armadillo (right) which roamed the South American continent in ancient times. Some stories hold that the giant sloth survived until quite recently and hint that a few of the creatures might still be alive.

De Loys' ape popped up again in 1951 when a French engineer told of encountering a similar creature in the same area of Venezuela. He too had a photo, which he said he had obtained from another jungle traveller. This new picture showed an animal that looked very much like de Loys' ape—too much like it. A close examination revealed that it was just a retouched copy of the questionable original.

No one knows whether the Loch Ness Monster, the yeti or de Loys' ape ever really existed, but there is no doubt that the giant sloth did. Several different types—some as large as elephants—had at one time or another roamed the Western hemisphere. The mystery is when did they die out, or is it possible that a few are still around?

At the end of the nineteenth century pieces of bone-studded hide ¾ inch thick and covered with reddish-grey hairs found their way into the labs of a few scientists. The hide looked like what some scientists imagined the hide of a giant sloth would have looked like. Coupled with stories of recent encounters with huge-sloth-like creatures, one man, Prof. Florentino Ameghino of Argentina concluded that the sloth was still alive. He christened it *Nemylodon listai,* in honor of Ramon Lista, an Argentine politician and explorer who claimed to have seen the beast.

Remains of sloth

The pieces of hide were ultimately traced to a cave at the southern tip of Patagonia. More sloth remains were found there along with evidence that man, too, had once inhabited it (although they had not necessarily lived there at the same time).

When the discovery was made, no way of accurately affixing a date to the remains in the cave existed. But in recent years, Carbon-14 tests of dung found there have showed it to be 10,000 years old. Is it possible

Advertisement

Russians Learn While Asleep

(WE KNEW IT ALL THE TIME)

News items appearing in newspapers and magazines throughout the nation report that: "In the Kiev State University, a woman student mastered a complete course in English in 28 nights."

"A philologist at the Ukrainian Academy of Science says that sleep-learning is less tiring to the brain than normal learning."

This "new" Russian discovery has been in use for over 2,000 years. In the United States sleep learning has been actively used since 1922 when Chief Radioman J. N. Phinney of the U.S. Navy successfully taught Continental Code during sleep. Since then, the use of sleep as a time for learning every kind of material, has become a reliable and accepted addition to our learning programs. The technique of sleep learning is being used by professionals, students and instructors, sales and corporate executives, housewives and mothers . . . along with many personalities in the public eye such as: Jan Sterling, José Ferrer, Red Buttons, Efrem Zimbalist, Jr., Sam Wanamaker . . . and many others — who use the time of sleep to absorb information effortlessly and painlessly for instant recall when awake.

To acquaint the readers of this newspaper with the simple techniques that allow constructive use of your sleeping hours, the Self-Development Research Foundation, a leading researcher in the field of learning while asleep, has published a compilation of Research Studies. These easy to understand reports tell you how to absorb any material while you sleep. Learn languages; learn to relax and control tensions; control your weight; sharpen your memory; develop your sales ability — all while you sleep, and without losing your rest.

This 26 page report is yours free. No obligation and no one will call. Simply enclose a dime to cover cost of postage and handling. Send your name and address to: Self-Development Research Foundation, Dept. Y-33, 207 East 37th Street, New York, New York 10016. Please include your ZIP CODE.

that the "sloth-hide" was this old and for some unknown reason had remained in a remarkable state of preservation? Is it possible that it was not the hide of a sloth at all?

The trail has gone cold and the puzzle remains. Repeated attempts to find evidence for the continued existence of the giant sloth have come to nothing. Only the discovery of indisputably recent remains or, preferably, a living breathing giant sloth will clear up the mystery.

Elusive tazelwurm

The most famous "unknown" animal of Europe is the tazelwurm, ("snake with paws"). It's a stumpy, three- or four-foot-long poisonous lizard with either two or four short legs. The tazelwurm is said to live in the valleys of the Swiss and Bavarian alps. Local residents claim to be quite familiar with the creature but no one has ever succeeded in capturing one, dead or alive. The only good photograph is of highly questionable authenticity.

This brief article by no means exhausts the list of unknown animals. There is the Australian bunyips, the nandi bear from East Africa, the Babylonian dragon or sirrush, the waitoreke of New Zealand, the feared African mngwa, the 80-foot-anaconda, a fabulous snake from the jungles of South America, etc., etc.

Most are mythical, perhaps all of them are. But it would be exciting if at least a few turned out to be real.

Three kite-shaped buildings form the Man the Explorer pavilion, one of five subthemes of Expo '67. Split into four realms of exploration, the pavilion displays a glass replica of Polar Regions, a tank designed by Jacques-Yves Cousteau for divers to perform "undersea" experiments and a geological tour even shows a glimpse of the Earth's interior.

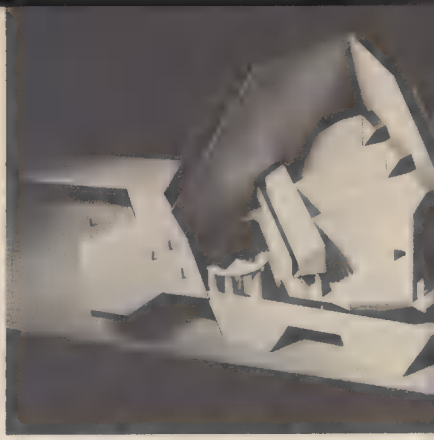
Expo '67 — Man and his world

SCIENCE has become an inextricable part of man's life—his health, resources, education, communication and exploration—and the effects are staggering. Advantages and problems that result from rapid technological and social changes are the multiple subjects of "Man and his World," the theme of the Universal and International Exhibition of 1967 in Montreal, Canada. Open from April 28 to October 27, Expo '67 is defined as a first category exhibition by the 31-member International Exhibitions Bureau. This means that the invited nations are responsible for construction of and displays in their pavilions. A World's Fair like New York's own, however, is an aggregate of business corporations hawking their wares in an international marketplace.

Montreal set aside 1000 acres of land, a good part of it man-made, for Expo '67, and put up $40,000,000

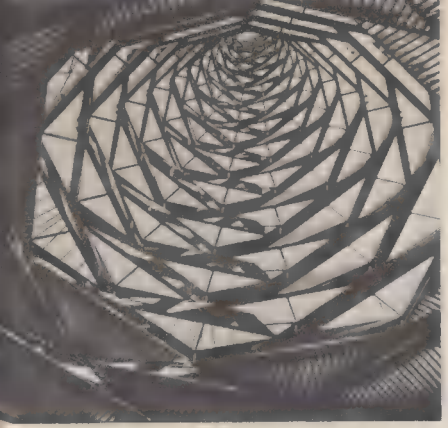
to build the theme pavilions (shown on these pages).

Divided into Man the Creator, Explorer, Producer, Provider and his Community, the theme embraces the gargantuan task of studying man. It will also try to project where the scientific revolution will take man in the 21st century.

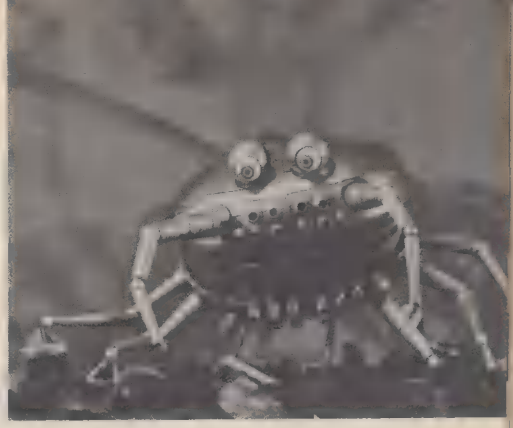


On Mackey Pier, a finger of land jutting into the St. Lawrence, is shoe-box-like Habitat 67, conical Man and Community next to it, Man and Health, where one idea of how medical research relates to man is spiders' reaction to LSD 'trip.'

Man and his Planet pavilion, above, shows three films of Earth. Habitat 67, below, is radical 12-story housing complex made up of 158 prefabricated units (each has private terrace) arranged unsymmetrically for maximum air and view.



Inverted cone, above, is inside view of Man and Community pavilion. Urban sprawl is growing cancerously and so are its problems. How man can cope with population and information explosions are just two of the subjects examined in the six exhibits.



The metal crab with the bulging eyes is the Gyrotron, an amusement ride with specially built cabins inside in which visitors will whirl up a 215-foot pyramid and then drop into volcano's boiling crater. Ride will remain in Montreal after Expo is over.

Plane's-eye view of Expo 67 shows four main areas for which 25 million tons of fill were used: Mackey Pier, entrance to exhibition; the two extensions of Ile Saint Helen; Ile Notre-dame, the man-made island; and La Ronde amusement area.

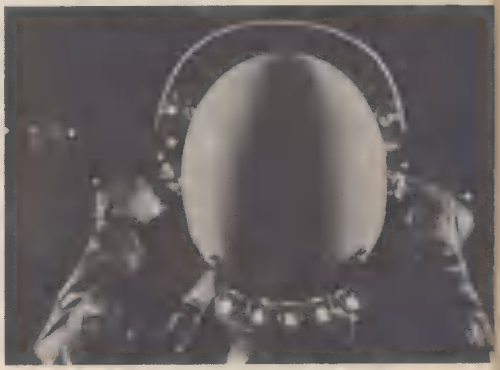
Getting up stairs and curbs is no problem for a buggy which is fitted with a "stairs-wheel." The star-shaped wheel can be attached with a minimum of tools and effort.

A small, powerful, cylindrical shaped magnet worn on ski boot (right) or in clothing greatly increases chance of survival if buried in a snow avalanche. Rescue teams equipped with a portable magnetometer (left) can rapidly trace the invisible victim's location in the snow by detecting the magnetic variation caused by the small magnet.

Model digs in among some of the 6,285 pairs of test shoes made of Aztran, the B. F. Goodrich Co's new leather-like material. The company submitted Aztran shoes to sundry tests and thousands of miles of wear.

A linear impact device slams a simulated human torso into a steering wheel at various speeds. G. M. engineers say this is an improved technique for testing steering assemblies and energy absorbing columns.

Flexible electroluminescent lamps are water thin and can be fabricated to any shape for an unlimited variety of applications. Some are only half inch high.



Motorcycle safety could be increased if riders would wear a helmet equipped with sequential directional signals developed by G. E. Thumb switch is on cycle handlebars.

Rear end collisions could be ended by laser distance and ranging (inset). Light pulses bounce off object in front of car and warn driver or stop the car if collision threatens.

U.P.I

China A-bomb films

The first films of the Chinese explosion of an atomic bomb ever to be shown outside of Communist China, were screened on Japanese television earlier this year. The color films were reported to be of the third Chinese nuclear explosion. Top photo shows brick house being destroyed by the blast. Below, the familiar mushroom shaped cloud of the explosion. The 40-minute film was made by Communist Chinese cameramen.

U.P.I

Science month

Computer tax check

THAT FEDERAL income tax return you filed last month has been checked by a computer. Two hundred computers in the seven U.S. Internal Revenue Regional Service Centers have serviced the more than 100 million tax returns representing $130 billion in collections.

According to IRS Commissioner Sheldon S. Cohen, all returns are processed in the service centers before being sent to the National Computer Center in Martinsburg, W. Va.

"At the National Center," he said, "the returns are matched against the master files, which include a record for every single tax paying entity in the country. The files bring together in one place for thorough scrutiny all tax transactions of all taxpayers. Every taxpayer has only one account and all information affecting his tax status is matched against that account and no other."

The nationwide system was initiated over the last five years.

How to lose weight

The more the physician learns about the various aspects of obesity, the more confusing treatment becomes. The constant stream of new methods of reducing the overweight patient are the result of poor re-

Chimps can tolerate decompression

Eighteen specially trained chimpanzees like the one above have been undergoing tests as part of an effort to devise procedures for astronauts whose spacecraft or suits are ruptured. Researchers find that chimps can take sudden and rapid decompression.

sponse to treatment, and should serve as a warning to the physician that obesity is one of the most difficult conditions to treat, writes Hilde Bruch, M.D.

An objective look at the patient's individual problems, not forgetting a touch of respect and sympathy, will often result in clues to the origin or reasons for obesity, according to Dr. Bruch, professor of psychiatry at Baylor University College of Medicine, Texas Medical Center, Houston.

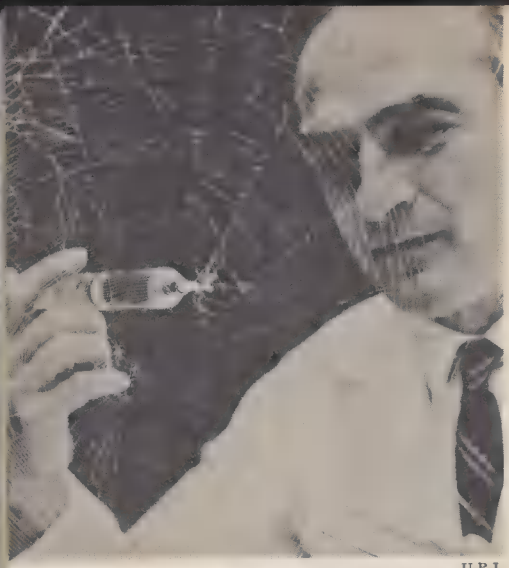
The problem of treating the obese individual should be considered in terms of age of onset, cultural attitude, the patient's degree of cooperation, life's stresses, and the physician's own preferences, rather than the simple assumption that fat is bad and should be gotten rid of.

The successful solution to a patient's obesity is often claimed too soon, Dr. Bruch suggests. "Our concepts of treatment of obesity would change radically if we could make it a rule to report results only after an adequate follow-up period, such as the five year follow-up in the treatment of malignancies."

Earthquake aftermath

The 1964 "Good Friday" earthquake in Alaska had a severe and disrupting effect on Alaska's lakes, streams and ground water.

A report published recently by the U.S. Geological survey notes



U.P.I.

'High' spider

Scientist injects LSD into a spider. Under the drug, spider builds an oversize web. Morphine slows ½ hour job to 3 hours.

that, "The extent of the hydrologic effects was possibly the greatest that has ever occurred on the North American Continent and probably the greatest ever recorded."

The report continues:

"Lake and river ice was broken for distances of 450 miles from the quake's origin as a result of seismic shock and oscillation of water in the lakes.

"The surging action temporarily 'dewatered' some lakes and ground breakage of stream beds and lake shores also caused a temporary local loss of water. Hydrologic recovery took weeks in some places.

"Ground water laden with sediment, erupted through cracks in the ground. The extrusions caused local cratering and land subsidence due to compaction from the loss of sediment and water.

"Landslides and snow avalanches temporarily blocked streams and diverted some permanently.

"Water quality was not changed except for temporary increases in muddied-water wells and streams.

All-time birth high

While the number of babies has declined from its record post-war level, new record highs are in store for the future, according to the statisticians of Metropolitan Life Insurance Co. Current figures point to a growing trend after the next few years, culminating in an all-time high in the mid 1970's.

Despite today's trend toward smaller families the statisticians agree that a future rise in the total number of births is almost inevitable. Already, the annual number of first births has increased from 1,118,000 in 1960 to over 1,160,000 in 1965, and an estimated 1,200,000 last year. Their number should rise more rapidly as the large contingents of post-war children reach marriageable age and build their own families.

For the duration of the Vietnam conflict, the continued military deferment of men with children may also contribute to the upswing in first births.

Uncharted sea floor

The discovery of dozens of previously uncharted undersea mountains, mountain ridges and sea basins in the North Pacific and Bering Sea was disclosed recently with the publication by the U.S.

Dept. of Commerce of six new maps of the sea floor surrounding the Aleutian Islands.

Known as bathymetric maps, they cover about 400,000 square statute miles of seabed where thousands of earthquakes are spawned each year.

The maps, the culmination of almost a quarter-century of painstaking work, are the most detailed of their kind ever made of this region. Produced by the Environmental Science Services Administration (ESSA), they were compiled using information gathered from more than 275 hydrographic surveys by ESSA's Coast and Geodetic Survey between 1943 and 1964.

Clean living

The Seventh Day Adventists don't smoke, don't drink, avoid tea and coffee and have, in the words of the *Journal of the American Medical Assn.* "a way of life which includes adequate rest, recreation, exercise, avoidance of tension and worry, good hygiene, and prompt cooperation with medical care." A study of 11,071 male members of the group conducted between 1958 and 1962 showed that they were outstandingly healthy as compared to men of comperable age from the general population. The deaths from all causes in the Adventist group were only half of that expected for most men. Deaths from respiratory disease were only one-quarter that expected.

Nuclear excavation effects

A team of scientists under the direction of the Battelle Memorial Institute are now studying the potential biological and environmental effects of using nuclear explosives to excavate a new sea level canal through the American Isthmus to connect the Atlantic and Pacific

The main objective of the three-

Stronger Plants With Air Pollution

Fly ash is discharged from smoke stacks and becomes an air pollution problem. Industries have been urged to get the equipment that collects fly ash before it reaches the atmosphere. This creates another problem: What to do with the vast amount of ash that accumulates. Scientists have found a number of uses. Ash makes stronger concrete block and brick, it is also a good filler for asphalt paving and, when added to the soil, it can increase the growth of plants as seen in the soybeans below left.

year program is to prepare a report for the Atomic Energy Commission from which a judgement can be made on the safety of using nuclear devices to dig the proposed canal. The sites being studied are in the Darien region of eastern Panama and the Atrato River basin in northwestern Columbia.

World's strangest people

Perhaps 300 full-blooded Ainu survive on Japan's northernmost island of Hokkaido. Like American Indians, these gentle aborigines have dwindled in the face of intermarriage, illness and successive waves of immigration by outsiders.

The Ainu remain one of the world's mysteries. They speak a language related to Japanese. Though the Ainu live among Mongoloid people, they look like Europeans. Most have fair, almost ruddy complexions, round eyes, and wavy black hair. The old men sport foot-long beards.

Some anthropologists believe the Ainu descended from a Caucasoid race that once ruled northern Asia. Others think the Ainu are the last survivors of a population that has lived on Hokkaido for at least 7,000 years.

Many Ainu elders say their race originated in space. A monument in the Saru River valley marks the spot where the first Ainu supposedly came to earth.

Two-million-year-old elephant unearthed

Richard and Margaret Leakey, children of the famous anthropologists Dr. and Mrs. Louis Leakey have recently unearthed the complete skeleton of a two-million-year old elephant in Africa. The Leakey elephant stood 13 feet at the shoulder, compared with 11 feet for modern elephants. Ivory tusks were straight and reached to the ground.

©National Geographic Society

American Museum of Natural History

The most hazardous days of your life

by James C. G. Conniff

MEDICAL science is beginning to investigate a world where every man has been and where, while there, he was more vulnerable than he will ever be again—the world of the unborn. The promise of work already under way in obstetrical amphitheaters and genetic laboratories could, in the near future, outstrip the space effort in significance for mankind.

Fetology—not yet officially a medical subspecialty but, according to the World Health Organization, already producing some 7,000 scientific papers a year—deals with the study of, and the diagnosis and treatment of diseases in, the unborn.

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Fetology has a long way to go, but the important thing is that it *is* in being.

Fetologists will need all the sophistication of technique they can come by, for their ultimate field of operation, the human embryo or prefetal conceptus, is breathtakingly tiny and infinitely complex. Such minuteness of essential elements is a problem for nature itself, even before conception takes place.

Phenomenon of conception

The coming together of egg and sperm to make a new human being is a small miracle. Of the approximately half-million ovarian cells (potential ova or eggs) an average woman's ovaries contain from birth, not more than about 500 will mature in most lifetimes. Alternating each month between left and right ovaries, ovulation, or egg-production, brings to the surface of the ovary one ovum in a tiny gelatinous bulge called a follicle. This little bag bursts, with a sometimes discernible twinge of pain, releasing an egg no bigger than the head of a pin, and of about the same shade of yellow as a light-yolked hen's egg, for its journey down the Fallopian tube to the uterus, or womb.

For conception to take place, this egg must be fertilized by a single sperm, the male parent's microscopic but essential contribution. Somewhat resembling tadpoles in shape, though so small that 100,000 together could barely be seen as a dot, the sperm come in two varieties: Those with r o u n d heads produce boy babies; those with oval heads, girls.

Under u s u a l conditions, most sperm are going to be destroyed by the acidity of the vagina, the passage they must traverse, swimming with powerful wriggles of their tails, at a rate of about 1/10 inch per minute. For reasons not yet fully understood, the round-headed, male-producing sperm are more easily killed off. But nature provides its checks and balances. The male-producing sperm are more numerous to begin with, so that their slaughter tends to balance out. Also, at the time of ovulation the potential mother's body chemistry somehow alters so as to provide a temporarily less-hostile environment for male-producing sperm.

In the second place, those sperm that survive to pass the cervix, the neck of the womb, may swim right past the egg without being drawn to it. Enough, however, hit it head-on to festoon it with thousands of lashing tails.

At last, one—and only one—sperm penetrates the tough *zona pellucida,* the glass-clear membranous shell of the ovum, and joins its pronucleus with that of the egg. At that moment conception takes place and, scientists generally agree, a new life begins.

During this early phase, when the woman herself has no sure way of knowing what vital processes are rapidly developing within her, critical decisions are being made—and carried out. The chromosomes in

the egg and sperm (23 in each, if all is well) have lined up in such a way as to produce a master plan for growth. Within three or four days the egg has divided and redivided into a cluster of 36 to 40 cells which will have moved out of the Fallopian tube into the uterus.

Five or six days after conception, the embryo will have grown to 150 or more cells, and will implant itself in the spongy wall of the uterus, which the body's hormonal mechanism has prepared to receive it. Organ formation follows swiftly. By the end of eight weeks the embryo will have become a recognizably human fetus.

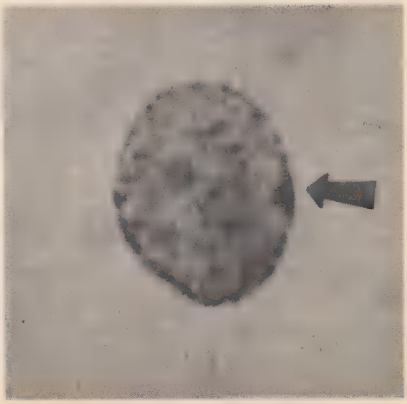
About the size of your thumb by the third month, the fetus trains freely like an aquanaut in the fluid of the amniotic sac which surrounds it—"weightless" as an astronaut—in order to gain the equilibrial competence it will need after birth.

Nourished and kept free of its own wastes by the blood-filled umbilical cord, which has anchored it and the ballooning amniotic sac to the uterine wall from the moment of implantation, the fetus has grown to perhaps a foot in length during the second trimester (or three-month period) of gestation—a rate of physical increase which, if it continued unabated, would at maturity engulf the earth. When, at last, the fetus displaces most of the sustaining fluid and is ready to be born, it nestles head-down in the uterus (unless the baby doesn't want to, in which case no amount of obstetrical maneuvering can make him, and he will be born breech, or hindside-to), and prepares to endure the 50-pound pressures of labor which will carry him into the waiting, gently assisting hands of the obstetrician.

The voyage to birth has been a warm, wondrous, but also demanding odyssey *in situ* of some 280 days. At the very start, while still a mere zygote—a fertilized egg—the future child may have been af-

Photos: Landrum B. Shettles

Spiky ball above is a living human egg blanketed with innumerable spermatozoa. The dark spot, below, in the nucleus of a human fetal cell is sex chromatin body, a sign of XX chromosomes, for a female.



flicted with a potentially disastrous matching of chromosomes, ranging from sickle-cell anemia (in which the red blood cells are malformed and incapacitated) to mongoloid idiocy (in which the inherited chromosomes add up to the equivalent of 47, instead of the normal 46).

As the embryo grows, it is subjected to fresh dangers. If, at this critical time, the mother has a nutritional deficiency or virus, or, unaware that she is pregnant, takes some powerful drug (such as one of the antinausea compounds that she may be naturally inclined to take in the circumstances), the even momentary interruption of the delicate process of development which any one of these eventualities may cause can damage the baby permanently in mind or body, or both.

Decimation of males

For these and other ill-defined reasons, many a zygote or embryo (especially if male) falters and is either resorbed into the mother's body or expelled by what is mistakenly regarded, in such cases, as the normal periodic event of menstruation. Embryologists conjecture that these "early spontaneous abortions," as doctors call them, help in part to explain why, although for every 100 females 150 to 160 males are conceived, only about 105 to 107 males are born. (The imbalance at birth is evened out, for reasons also not yet fully understood, by a continuing higher loss rate among males throughout life.)

All told, more than 1,000 different types of birth defects are known. The 16 major categories alone account for nearly 250,000 babies a year in the United States who are born damaged. No one yet knows how many are spontaneously aborted, or how many more are born with defects that show up only in later life.

Fetologists are vigorously at work on many fronts to remedy this disgrace. One line of research—already far advanced toward success—seeks a vaccine for the mother against German measles (or rubella), a seemingly mild infection that, as demonstrated in the 1964-65 epidemic, when contracted by a pregnant woman can produce disasters for her unborn child, ranging from cataracts or deafness to heart malfunction or mental retardation.

A more dramatic development is the technique called amniocentesis, first used in England about 1950 by Dr. D. C. A. Bevis. The doctor pierces the mother's abdomen and uterus with a thin, hollow needle and through it draws off a few cubic centimeters of fluid from the amniotic sac. The fluid contains cells which the fetus has sloughed off. Centrifuged, stained and inspected under a microscope, the cells will reveal their chromosomal structure, indicating not only whether the unborn child will be a boy or a girl but, more important, whether there is a chromosomal malformation.

Amniocentesis is just a bit too risky (there is a slight chance of infection or, more remotely, of damage

Chromosome damage in fetus can be detected by amniocentisis, a process in which fetal cells are drawn from uterus.

to the fetus) to use for casual satisfaction of parental curiosity. Practitioners therefore confine it to cases in which they suspect a serious hereditary defect. Some, if diagnosed early enough, can be treated and kept from doing permanent damage.

Others, such as those resulting from thalidomide damage, can be accurately diagnosed *in utero* but only too late to be aided by any known means.

One defect that can be treated is that caused by the Rh factor. Most human beings have it and so are called Rh-positive; about one American in seven is Rh-negative. Trouble can arise (particularly in second and subsequent pregnancies) if the mother is Rh-negative and the father Rh-positive. Her blood may develop antibodies—rather as if fighting off an infection—that ravage the vital red cells of the infant. Often, the baby is stillborn; if it survives, it is likely to be drastically anemic and mentally retarded.

The answer, as developed by Dr. Albert W. Liley at the National Women's Hospital in Auckland, N.Z., in late 1963, is an extension of the amniocentesis technique—the use of a hollow needle not only to "tap" the uterus but to give the ailing fetus an actual blood transfusion, replacing as much as 90 percent of its thin, watery blood with a load of healthy, enriched red corpuscles. Such transfusions have been given as early as the 22d week of pregnancy, enabling the fetus to survive either until term, or at least until sufficiently developed (at 32 weeks or so) to survive a premature delivery.

At Columbia University's College of Physicians and Surgeons, Dr. Vincent J. Freda injects into the amniotic fluid a radiopaque dye which the fetus promptly swallows. After accurately locating by fluoroscope the fetus's abdomen (now clearly defined by the radiopaque material), he swiftly places within it the transfusing needle's tip. Speed is essential to keep the fetus from wriggling away when it feels the needle, and the doctor has to put that needle in just the right place to avoid injuring some other organ and to make sure the fresh blood goes where it should.

RH blood transfusions

Dr. Freda then slips a plastic catheter (or hollow tube) no thicker than the wire of a paper clip through the core of the needle, and begins transfusing blood into the fist-size abdominal cavity. The abdominal walls absorb the blood directly into the circulatory system. As many as four transfusions may be necessary, at 12-day to 14-day intervals, to restore an extremely anemic fetus.

The most radical approach of all —undertaken for the first time ever by two other Columbia surgeons, Drs. Karlis Adamsons and Albert Plentl—involves semidelivery of the fetus. Through the uterine and abdominal walls, the surgeon draws forth a fetal limb, inserts the catheter into a blood vessel, and restores the limb to the womb with the catheter in place for subsequent transfusions. Limited for now in man but highly promising for tomorrow, the technique dates from German surgery on fetal lambs as long ago as 1884.

Fetal surgery

No one can say for certain where the possibilities of fetal surgery may lead. Doctors can already tell, by sampling scalp blood with a hollow needle, when a fetus is not receiving sufficient oxygen—a major cause of brain damage. That skill now enables them to save the child by a premature delivery by Caesarean section. For the future, they hope to find a means of surgically improving the oxygen-transport mechanism of the mother's blood, thereby permitting an oxygen-deprived fetus to continue to term.

Hydrocephalus, or compression of the brain tissue by excessive fluid in the cranial cavity, is now treated after birth by an operation to relieve the pressure. But the condition can often be diagnosed in the fetus, either by X rays or by ultrasonics (an adaptation of the sonar techniques used to detect submarines). Fetologists expect that they will in time be able to prevent progressive brain damage in a hydrocephalic fetus by performing the relieving operation before birth.

On another front, researchers are pursuing a chemical approach. There are suggestions that retardation may be related to (among other factors) a speed-up in the metabolic process by which nutrients are converted into cellular material—including the developing brain cells. Dr. Jerome Lejeune, the French discoverer of the chromosomal key to Mongolism, urges studies to confirm this probability, and then to develop enzymic medications that could be given in early pregnancy to slow down the process.

At Columbia, Dr. Freda, in collaboration with Dr. John G. Gorman, a research hematologist, has just proved out a gamma-globulin compound rich in passive Rh antibodies which, when injected immediately after a first delivery, suppresses the response that could hazard future pregnancies. The purified substance was provided by Dr. William Pollack of the Ortho Research Foundation in New Jersey. Together with other investigators, Drs. Freda and Gorman have used their discovery on more than 350 Rh-negative women. An obstetrical milestone, it has been 100 percent successful to date in preventing the Rh factor from menacing a subsequent pregnancy.

Dr. Freda says that the main thrust of fetological research must be toward improving intrauterine

The menacing RH-negative factor has been successfully suppressed in 350 women by a gamma-globulin compound

diagnostic techniques. With the means to identify infections that now kill babies in the first hours after they are born, doctors may be able to begin antibiotic therapy earlier and so save the lives of babies with, say, congenital pneumonia.

Research into why the oxygen supply *in utero* goes wrong could lead to ways of combating hyaline membrane disease—the leading cause of death in premature infants. Amniocentesis may prove useful in confirming the presence of certain sex-linked hereditary disorders—such as hemophilia and delayed or ambiguous genital development in male babies—early enough to allow preventive action. Other disorders which may yield to this technique because they affect the sexes differently are types of muscular dystrophy and a kind of congenital blindness with severe mental deficiency called pseudoglioma.

Risk to placenta

Some obstetricians advance professional reasons for avoiding surgical intervention in the pregnant uterus. For example, they point to the hazard of placental separation—that is, the risk a doctor runs in piercing a pregnant woman's abdominal and uterine walls with a needle, of dislodging the placenta, which anchors and sustains the fetus, thereby bringing about the death of the infant the doctor is trying to save. Another danger they cite is the risk of accidental blood-exchange between mother and baby to bring on an Rh condition, even in a first pregnancy, with no one the wiser until unsuspected Rh anemia results in stillbirth. There is also the danger of infecting the amnion (the membranous sac containing the fetus), of transfixing the fetus, even of penetrating the mother's bladder—all of which the skilled practitioner of amniocentesis goes to enormous lengths to prevent. Nonetheless these "speculative risks" can hardly offset the merits of amniocentesis in those Rh cases where it is indicated.

Such authorities as Dr. Jerold F. Lucey, associate professor of pediatrics at the University of Vermont and chairman of the Medical Advisory Committee of the National Foundation-March of Dimes, for example, flatly take issue with the critics and scores their attitude as a serious obstacle to progress. "Some risks we will have to take are worthwhile because the possibility of learning a good deal will help many more people than we might harm," says Dr. Lucey. Besides, he adds, "once we learn what, within the uterus, is a hazardous condition or a deviation from the normal . . . we may find that what we consider risky today may not be risky at all."

This time exposure picks up paths of the two rockets probing mysteries of northern lights: Aerobee, traveling through aurora and Javelin, soaring to 600 miles above aurora.

Rockets bombard the aurora

THE mysterious ribbons of color that blaze across the polar skies are under attack.

Near the Hudson Bay port of Ft. Churchill, Canada, an army of 100 scientists and technicians from *Johns Hopkins, Maryland, Pittsburgh, Colorado and Rice Universities* have been blasting away at colorful displays of the aurora borealis with an arsenal of Aerobee and Javelin rockets during this past

frigid winter night. The "weapons" are equipped with special nose cones containing sophisticated electronics packages, designed to find out what causes the brilliant lights, why they assume the shapes they do and, thus, to find keys to some of the riddles of the earth's upper atmosphere.

According to physicist William Fastie, who heads up the five-man team from *John Hopkins U.*, "The rocket barrage is being launched from 9° below the Arctic Circle because there is a narrow 1° band in latitude there where the aurora occurs most frequently." It is seen every night at Churchill.

The Aerobees, soaring 100 miles up through the aurora, transmit data picked up by their photometers and spectrometers for five minutes. The 600-mile-high Javelins collect information on energy distribution of the aurora particles and the Van Allen radiation belts, from positions above the light displays.

Down below, in the Churchill Research Range on the barren tundra of northern Labrador, scientists cluster around receiving equipment housed in bleak, wind-swept buildings and mobile vans, monitoring transmissions from space and making ground-based measurements.

For years, it has been known that the vivid draperies in the polar night skies are caused by high-energy electron streams pouring in from space and colliding with the earth's upper atmosphere. The spectacular effects were laden with superstition for mankind as recently as the seventeenth century. Later, they became—along with icebergs—a prime tourist attraction for passengers on liners in the North Atlantic.

Because of the outlandish locations where aurora are visible, few people are aware of them beyond the annoyance of radio interference (and sometimes radio blackout) that accompanies them.

"There are many facets we still don't understand," says Fastie. "I think that now, with NASA's support for rocket work, and with the increasing interest of other universities, we are going to solve the aurora's mysteries within the next five years."

This is the fifth year of Johns Hopkins aurora work. Next year, more than 250 scientists will go to Churchill for the greatest effort of all. Three rockets will fly, while a NASA Convair 990 follows the auroral rainbow below them on a data collecting flight.

Aurora borealis is subject of dual-thrust study by five universities and government.

News from the quadrangles

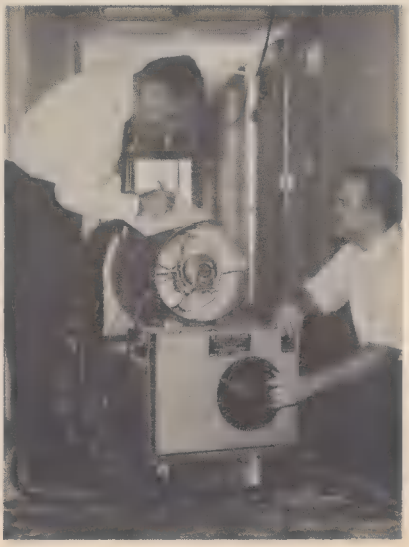
"People Machines" at work

Word finally filtered out that there were ten "people machines" taking notes in a locked-up girls dormitory at *The Pennsylvania State University* all last summer.

The whirring gadgets, called SIMOC (for "simulated occupant"), were busy finding out how uncomfortable a crowded building can get in hot, humid weather.

Each SIMOC—essentially a humidifier-heater—"breathed" into the building the amount of moisture that would be exhaled by up to 60 people in normal respiration and perspiration. Object: to learn just how many real people could be accomodated in a public building (such as a fallout shelter) in case of emergency.

Professors Everett and McLaughlin ready "people machine" for heavy breathing duty.



It used to be a rule of thumb that 10 square feet per person was necessary at 95° F. and 50 percent humidity. The "people machine" team—including Professors John Everetts, Jr., Everett McLanghlin and research assistant Robert Allen—indicate that is all very well in cool weather. But their SIMOCs may have some pretty muggy news coming up.

Remote Control lectures

From a classroom in the College of Engineering at the *U. of Michigan,* Instructor Marlin Ristenbatt is giving a series of 24 lectures on semiconductor circuits to engineers at three industrial plants located from 50 to 100 miles from Ann Arbor. His system involves an "electronic blackboard" that instantly relays his drawings and figures to large screens in the remote classrooms, plus new telephone equipment permitting two-way conversation with each group. It's part of the university's effort to expand teaching services to Michigan industry.

Dental decay note

Five hundred children aged five to 16 years recently were treated to pre-sweetened breakfast cereal for two years by three *Indiana U.* School of Dentistry scientists. Pro-

fessors George Stookey, Joseph Muhler and Dr. Roger Carroll knew the secret. The kids didn't. Half the group were eating straight presweetened cereal; the other half had the same, but with sodium dihydrogen phosphate added. Results of the experiment have just been published: those who ate the phosphated cereals showed 20 to 40 percent fewer cavities.

Down memory lane

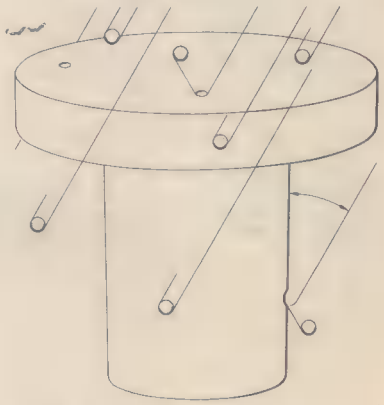
Thirty "intellectually above average" student volunteers at the *U. of Michigan* were involved in an experiment at the school's Mental Health Research Institute recently. Divided into groups, some were given the new drug, magnesium pemoline, which reportedly enhanced memory and learning ability in rats. Others were given sugar pills. Upshot: those who had the sugar pills did just as well in tests.

Bugging the bugs

A hidden mike attached to the underside of an aluminum pie tin is listening in on the private lives of 25 varieties of cockroaches at *Ohio State U.* The subjects include everything from common cracker-box brown roaches to three-inch-long whistling monsters from Madagascar. Dr. Frank W. Fisk, entomologist, and graduate student James Frazier, explain that their purpose is to determine the daily rhythm of the insects. They're supposed to be nocturnal, but the snooping microphone has picked up their greatest scuttling at 6 A.M. when the laboratory lights come on, with another big commotion at dusk.

Wetter rain water

Climatologist Stanley Changnon *at the U. of Illinois* is building a 14-inch polystyrene mushroom to use as a target for hailstones. The device will automaticaly record impact force, size, angle of impact and concentration of hailstones in sparsely populated areas during hail-bearing storms.



Dents in plastic mushroom record size, concentration and angle of each hailstone.

From the information his mushrooms supply, Changnon hopes to obtain data that will be helpful in future hail modification programs, aimed at cutting down mass crop destruction that has plagued farmers for years. This month, some 2,000 farmers will keep records of hail activity on their farms for a six-month period.

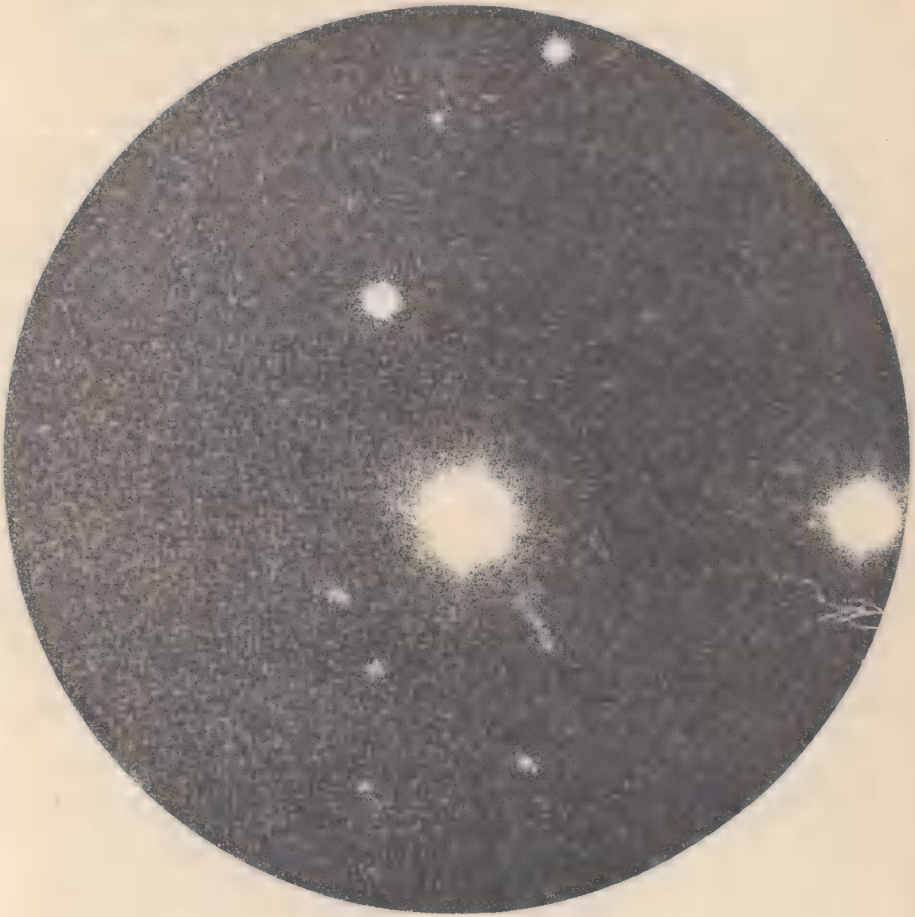
Three Lions Photos

Bang! Knob of trigger plant strikes ladybug's back, dusting it with pollen. Job done, stem rotates downward again. But this action resets the flower's trigger mechanism.

Pollination by force

THE trigger plant belts passing insects with a powder-puff hammer. It either dusts them with a thick smear of pollen, or removes it from pollen-carrying individuals, depending on what happened to previous insect. The trigger, which gives the plant its common name, acts just like that. When an insect lands on the flower, the weight triggers the release of a curved column with a pollen-covered knob at one end. The blow is quick but the insect is unharmed, except that it now has a load of pollen.

Business end of trigger plant is poised to strike ladybug, who has not yet tripped trigger releasing pollinating mechanism.



Explosion in astronomy

The discovery of quasars and other mysterious objects in the sky has been made possible by advances in electronics, optics and chemistry. This has thrown astronomy into a state of 'exciting confusion.'

by Graham Berry

MYSTERIOUS, star-like objects in the night sky have touched off a new hunting cry among astronomers. The strange, explosive, enormously energetic objects apparently are far out in space. The more they are observed, the more confused sky-watchers become. The objects are demonstrating some new physics that nobody understands.

The brilliant bodies are, of course, quasars. They have touched off the greatest astronomical controversy since the discovery of galaxies some 40 years ago. But actually, quasars are only one of several newly-discovered sky mysteries. There are blue stellar objects, radio galaxies and X-ray sources. The discoveries of these new classes of objects have been made possible by advances in electronics, optics and chemistry. In short, astronomy is undergoing a major revolution.

The startling new views of the universe through the newly discovered windows in these fields have thrown the oldest of the sciences into a state of exciting confusion as it continues to pursue its several traditional grand-scale goals:

1. Understanding the birth, evolution and death of the solar system, stars, galaxies and the universe itself.

2. Determining the size, shape and structure of the universe.

3. Finding out whether life exists elsewhere and in what varieties and quantities.

To these objectives have been added a new one: Learning the nature of the newly-discovered objects, their evolution and links, if any, with stars and galaxies. Much interest is concentrated on quasars, blue stellar objects and radio galaxies because they appear to inhabit the universe at great distances. The quasars and blue stellar objects are considered to be the long-sought beacons that may illuminate the distant parts of the universe so that we can see what's going on out there. Or rather, what was going on long, long ago.

Slicing up the universe

Astronomers who, like other scientists, sort and classify things, have sliced the universe and its inhabitants into phyla and species. Astrophysicist Jesse L. Greenstein of the California Institute of Technology and the Mt. Wilson and Palomar Observatories sees three major classifications:

1. The peaceful, slowly evolving processes of stars and galaxies. 2. The incredibly violent, relatively short-lived events, such as exploding stars, galaxies and probably quasars. 3. The big mysteries, including how things began, the role of intelligence in the universe, extraterrestrial life.

There is a fourth category, probably a subheading under the third. However, it is rarely mentioned in polite astronomical society. That is because only a layman would ask such presently-unanswerable questions as: Are there any other universes besides our own? If hydrogen is the elemental chemical element

Small stars outlive blue supergiants by some 30 trillion years, because they burn hydrogen fuel more slowly.

from which all others have evolved, where did the hydrogen come from?

"There seems little doubt that we now recognize, and have progressed far in understanding the most important of the normal processes," Dr. Greenstein declares. "These include the evolution and behavior of 'normal' stars and the great congregations of stars called galaxies. Paradoxically, more is known about what goes on inside of a star than inside of the earth."

Theories developed from observations of stars cover the reasons stars come in assorted colors—red, white and blue, and yellow—and in a variety of sizes ranging from white dwarfs smaller than the earth to red supergiants up to half a billion miles in diameter.

The theories account also for the reasons why blue supergiants live only for three million years while modest, slow-burning, small stars have a life expectancy of 30 trillion years! Most blue supergiants have long since expired while the smallest stars have only begun to live. Small stars survive longer because they consume their hydrogen fuel much more slowly.

All stars are presumed to have condensed from hydrogen clouds, with gravity compressing the gas into a smaller and smaller sphere. As the atoms of gas are drawn closer together, they begin to collide, the friction producing heat. When the cloud's core reaches a temperature of five million ° F., a nuclear fire is ignited in the core and hydrogen fuel is converted into helium "ash." As a result, enormous amounts of energy are released. The energy travels as heat and light through the star's outer layers, which heat up and radiate the energy into space as light and heat. The stability of stars depends upon the balance of two opposing forces, the contracting effects of gravity versus the expanding pressure of the heated gases.

The conversion of hydrogen into helium maintains the star most of its life. After hydrogen is exhausted, the star begins to swell, becoming a red giant. The sun is expected to reach this evolutionary stage in another five and a half billion years.

In our Milky Way Galaxy, stars still are being born of interstellar gas, much of it presumably left over from the beginnings of the galaxy, more than ten billion years ago. Some galaxies have little gas left. In them star birth has ended.

In the universe, the herd instinct applies. Stars reside in celestial megalopolises called galaxies. The Milky Way Galaxy, of which our sun and its planets are members, contains 200 billion suns and measures some 100,000 light years in diameter.

There are three "standard" kinds of galaxies. Eighty percent are pinwheel spirals—like our own—with a

Mt. Wilson and Palomar

The exploding galaxy M-82, photographed by Allan Sandage with 200-inch telescope. Filaments extend outward 10,000 light years on each side of the galaxy's center.

central nucleus of stars flanked by two or more spiral arms of stars, gas and dust. Seventeen percent are elliptical or spherical galaxies and contain mostly stars and very little gas. More densely populated with stars than spirals, ellipticals are bigger and brighter and hence can be seen farther away. The remaining two or three percent of the galaxies are irregulars or peculiar cloud-like structures of stars and are rich in gas.

Evolution of galaxies

The investigations into how galaxies are born, mature, grow old and die is in its early stages. Observations indicate that a galaxy starts as an enormous gas cloud that gradually condenses under its own gravitational attraction. Spirals are believed to start as an irregular, condensing, cloud-like structure that begins to rotate and develop spiral arms.

Stars are formed where the gas is densest. Many of these are short-lived blue giants. As the spiral arms, at first spread wide and loose, tend to tighten up with age, all the gas will be converted into stars. Finally, the galaxy will appear like a flat, thin pancake with an elliptical nucleus, the whole composed of old, dying stars that are red.

Elliptical galaxies are not nearly so flattened as spherical galaxies. In the very early days of the universe they must have looked differently, containing many young, large, bright stars. Now they harbor only very old stars.

Galaxies made of denser gas and dust probably evolve much faster than others. Therefore, at the present time, although all galaxies may be about the same age, they presumably are of different evolutionary ages.

Just as gravity herds stars into galaxies, so does this force pull galaxies into neighborly proximity with

"Red shift," based on the Doppler effect, is yardstick used to measure how fast galaxies are moving away from Earth.

each other to form the grandest structure known in nature—the cluster of galaxies. Clusters range in size from a dozen galaxies to a thousand, and stretch away as far as the giant eye of Palomar can see in any direction.

Are the myriad galaxies floating in clusters that are more or less at anchor in space? On the contrary, the clusters appear to be rushing away from the earth and from each other. And amazingly, the farther away the galaxies, the faster they appear to be receding. The evidence for this is the celebrated "red shift," which is the carefully calibrated yardstick for measuring great distances.

It is based on the simple observation that the dimmer a galaxy appears to be in brightness, and hence the farther away it must be, the more its light will be shifted toward the red end of the spectrum. In the laboratory and in the universe this shift of light is analagous to the Doppler effect. The faster a light source moves from an observer, the redder the light will be because the recessional speed stretches out the light waves. The longer light waves are at the red end of the spectrum. Thus it is believed that the red shifts of galaxies are due to this Doppler effect, and that the greater the red shift, the faster the rate of recession.

"The red shift has been observed for several thousand galaxies," Dr. Greenstein points out, "and it is found proportional to distance over the part of the universe within which we can measure distances by other means."

These findings gave rise to the generally accepted idea that the universe is expanding. Many astronomers believe it began with a "big bang" between 10 and 13 billion years ago.

All the way out to the half-way point in the universe, Dr. Greenstein declares, astronomers have the comfortable field of the "normal" universe, populated with galaxies and radio galaxies. From the half-way point in the universe and beyond, the recently-discovered explosive objects play a dominant role in the observations.

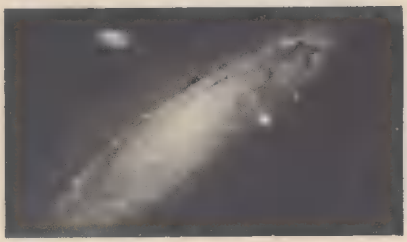
Violence necessary

Only recently have astronomers discovered that violence is not a rare thing in the universe, but is part and parcel of its activities. The ancients would have thought anyone crazy for suggesting that stars explode. People had considered the heavens to be quiet and tranquil, a fitting place in which to retire forever.

Now it is conceded that not only do stars commit suicide, but that galaxies undergo explosions so titanic that they persist for more than

(Continued on page 50)

How much do you know about stars?



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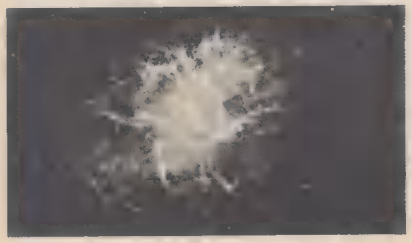

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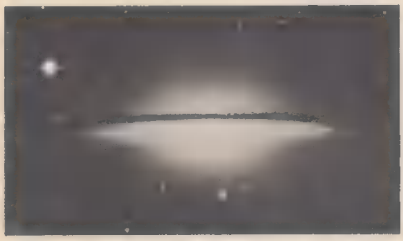
PICTURED below are 16 astronomical objects, photographed by the Mt. Wilson and Palomar observatories in California. Many should be familiar to the layman, others only to those with a special knowledge of astronomy. Test yourself, and check answers on page 52.



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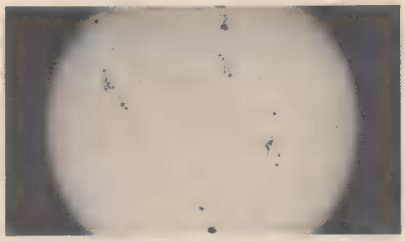

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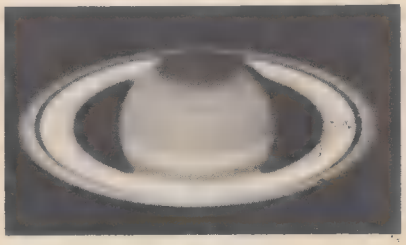

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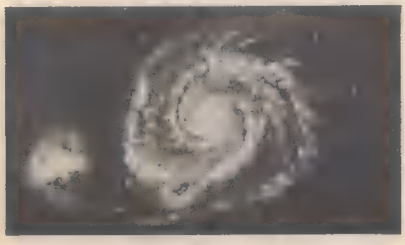

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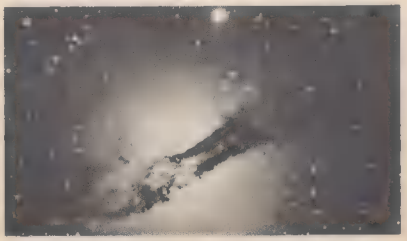

P

(Continued from page 47)
a million years. And then there was the "big bang," the explosion of the entire universe.

"Remnants of this very hot phase of the 'big bang' may have been found recently by the detection of radio waves that may have been reverberating through the universe from that early 'big bang'," Dr. Greenstein says.

Drs. Arno A. Penzias and Robert W. Wilson of Bell Telephone Laboratories recently detected radiation in space that a Princeton University group predicted would exist as a remnant of the first radiation to become disengaged from matter after the big bang. This corroborated the earlier work of Dr. George Gamow, now of the University of Colorado.

Aside from the "big bang," the ultimate in cosmic violence may well be the quasar. They are considered to be the brightest, most energetic objects in the universe. Recently, Dr. Allan R. Sandage of the Mt. Wilson and Palomar Observatories observed one of them—3c-446—to increase in brightness 20-fold in a matter of weeks. The astronomer described the event as the most violent so far observed ■ quasars.

What definitely is known about these objects? They look like ordinary, faint stars. But they are much farther away than the most distant star in our galaxy. More than 120 of them are known, and there may be thousands of them, estimates Dr. Maarten Schmidt of Caltech and the Mt. Wilson and Palomar Observatories.

They are the most energetic objects known, squandering energy at a fearful rate as light, radio waves and ultraviolet light. One quasar can emit more light than 100 galaxies! The light and radio signals from several of them fluctuate markedly, implying that they cannot be nearly as large in diameter as a galaxy.

Dr. Greenstein says that perhaps what we see is a hot gas cloud a million times heavier than the sun. Inside the cloud must be a super-energy generator.

"Inside what we can observe in the quasars is something quite unknown," Dr. Greenstein declares. "It is some source of energy not yet understood. The very hot core must be less than one light year (six trillion miles) in diameter.

Quasars' red shift

"Unexplained high-energy phenomena still exist in quasars, and also in radio galaxies, supernovae (exploding stars) and in the cosmic radiation itself. The next step forward in astronomy will involve their exploration and understanding."

The most remarkable thing of all about quasars is their red shift. Some of them have red shifts indicating that they are farther away than any other known objects and that they are receding from us at 80 percent or more of the velocity of light! The largest known red shift for a galaxy is only 46 percent.

The big question is: Are these

One of the theories about the nature of quasars is that they're miniature universes that have just begun to expand.

quasars as far away as their red shifts indicate that they are? If they are, then what is known about physics is hard put to it to explain how they can emit so much energy and be so bright.

If they are not far away, then what nearby phenomena could have generated enough energy to eject them at up to 80 percent of the speed of light? There is a possibility, of course, that part or all of the quasar red shift is due to something other than velocity. Some astronomers have raised this point.

Attempts have been made to test the validity of the quasar red shift by looking for a quasar in a cluster of galaxies. It would be easy to compare the red shift of that quasar with those of the galaxies in that cluster. If the red shifts were similar it would show that the quasar red shift is a valid distance and velocity indicator. Unfortunately, none has been found in a cluster with ordinary galaxies. Quasars do not seem to conform to the gravitational herd laws, but appear to be "loners."

Astronomers are split on the important question of how far away are quasars. The pioneer quasar observers—Dr. Sandage, who discovered the first three with Dr. Thomas Matthews, now at the University of Maryland, in 1960, and Dr. Schmidt, who determined the first quasar red shift in 1963—are among those who believe the red shifts are valid distance and velocity indicators.

Dr. James Terrell of Los Alamos has suggested that quasars exploded out of our galaxy. Fred Hoyle of Caltech and England's Cambridge University and Dr. Geoffrey Burbidge of the University of California at La Jolla propose that quasars were shot out of a nearby radio galaxy. Dr. Halton Arp of the Mt. Wilson and Palomar Observatories believes that they were ejected from peculiar galaxies that appear to have experienced violent activity.

There are other theories, including the suggestion that they may be supermassive stars and also that they may be miniature universes that have just begun to expand.

"Even if quasars are not as far away as their red shifts indicate," Dr. Greenstein declares, "they are still very small and are at least a billion times brighter than the sun."

Another significant new class of object discovered two years ago by Dr. Sandage is optically similar to quasars. He calls them quasi-stellar blue objects. They too are very bright and are strong emitters of ultraviolet light. And some have very large red shifts. However, unlike quasars they do not radiate energy in the radio frequencies at a level that can be detected with existing instruments. Because they are believed to be 100 times more

numerous than quasars, they, also, are expected to be very useful as tools in solving cosmological problems. The blue stellar objects have all the characteristics of quasars, except in the intensity of their radio emission.

A comparatively new class of object is the galaxy that emits radio signals as well as light. Fortunately several have been found in clusters of galaxies and their red shifts are similar to those of the ordinary galaxies that are located in the clusters. Thus their red shifts are known to be good distance indicators.

While some astronomers are more concerned with the new, distant objects, others specialize in nearby phenomena like the solar system. Space technology is adding greatly to our knowledge of the moon and nearby planets.

Is solar system unique?

Paradoxically, Dr. Greenstein classifies the solar system in the pigeonhole labeled "abnormal and unexplained." This is largely because it isn't known whether the solar system is unique. He points out that only one star besides the sun is known to have a planet-like companion.

The study of planets invariably evokes the question whose answer will have immense impact on man's thinking: Does life exist elsewhere?

"The discovery of life on another planet would be one of the most momentous events in human his-

(Answers to quiz on pages 48-49)

A. NGC 224 Great Nebula in Adromeda. Satellite nebulae NGC 205 and 221 also shown.

B. Jupiter, shows large red spot, satellite Ganymede and shadow above.

C. NGC 147 Galaxy in Cassiopeia shows resolution into stars.

D. NGC 1952 "Crab" Nebula in Taurus.

E. IC 443 Gaseous Nebula in Gemini.

F. NGC 1432 Peiades, an open star cluster in Taurus.

G. "Horsehead" Nebula in Orion south of Zeta Orionis, IC 434.

H. Solar prominence 205,000 miles high.

I. NGC 4594 Spiral galaxy in Virgo, seen edge on.

J. Nebulosity in Monoceros, located in south outer region of NGC 2264.

K. NGC 6720 Planetary nebula in Lyra. Messier 57, "Ring" nebula.

L. NGC 5194 Spiral nebulae in Canes Venatici.

M. Photograph of sun at sunspot maximum December 21, 1957.

N. Halley's Comet photographed from Honolulu May 12 and 15, 1910.

O. Saturn and ring systems.

P. NGC 5128 Galaxy, a source of radio noise.

Objects in the universe "speak" in many languages, from long sound waves to ultra-short X rays and gamma rays.

tory," emphasizes Dr. Norman Horowitz, bioscience manager of Caltech's Jet Propulsion Laboratory and Caltech professor.

Dr. Greenstein agrees and adds that if life does exist elsewhere, it may be too far away for us to learn about it. Then there is the possibility, he mentions, that we are indeed alone in the universe.

It's hard to imagine that an insignificant cosmic entity like the earth has exclusive rights to the most interesting form of matter. However, no evidence has yet turned up proving the existence of life elsewhere.

Fortunately, astronomy has a growing arsenal with which to attack these and other cosmic perplexities. The arsenal includes several new astronomies, each opening a new window to the universe.

"Optical astronomy alone cannot develop a complete picture of the universe," says Dr. William A. Fowler, Caltech physicist and pioneer researcher in the nuclear synthesis in stars. "The universe is a big place. We need to assess all the information available to us. Visible light is only a small part of the available information.

"Many objects in the universe radiate in other segments of the electromagnetic spectrum, and in addition, emit high energy particles of many types."

The universe speaks in many languages, ranging from the long wavelengths of the radio frequencies to the ultra-short waves of X rays and gamma rays. Each language conveys different information and is recorded on special instruments "tuned" to its wavelengths.

A quasar, for instance, speaks several languages. One is that of visible light. Spectroscopes attached to optical telescopes sift and sort light waves from an object to produce information about its energy processes, chemical composition and motions.

Quasars also "speak" in the radio frequencies, a not fully understood language recorded by radio telescopes. Radio signals emanate from high energy processes and tenuous gas moving at high velocities in magnetic fields. Quasars also emit infrared radiation, received through optical telescopes by infrared detectors, that describe the surface heat of objects.

Among other languages spoken by the universe's inhabitants are those of X rays and gamma rays. These also must emanate from unknown high energy processes.

There also are two interesting "particle languages"—those of cosmic rays and neutrinos. Cosmic rays emanate from violent events like the explosion of stars and galaxies. Neutrinos, generated in the nuclear fires of stars, are believed to be the only particles to escape unchanged

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from these furnaces. Astronomers hope to trap the elusive particles in sufficient quantities to obtain a look into the interiors of the sun and stars.

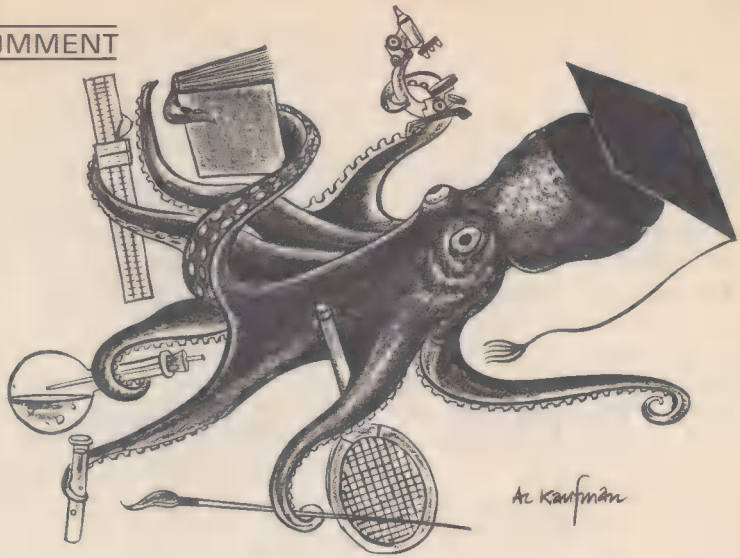
Radar technique

A near kin of radio astronomy is radar astronomy. Radar sends a signal and then listens to its bounce echo off the moon or a nearby planet. This technique has penetrated the clouds of Venus to reveal mountain ranges and the fact that Venus rotates backwards.

Technology also has expanded the abilities of optical telescopes. Recently Eastman Kodak Company developed a photo emulsion that greatly extends the distances that telescopes can see into space (*Science Digest*, April 1967). It enables the big eye of Palomar to record objects that are three times fainter than before.

The optical eye also has been improved markedly by a device called the image tube, which converts photos of light into electrons. The electrons are multiplied and projected onto a screen, forming an electronic magnification of an object.

Through technology, which has opened several new windows, a broader, deeper view of the universe is being obtained. As a result, more questions are being uncovered than answered. The questions are provocative. The answers will be even more so, and will profoundly affect our lives and thoughts.



We need scientific diversity

WHY not a single suit for man that adjusts to weather changes, or the ability to grow another finger? How about preserving man's sexual activity beyond the age of 50, or re-creating a baby woolly mammoth?

What's needed is scientific diversity, states John R. Platt, associate director of the Mental Health Research Institute at the University of Michigan. Scientists concentrate on certain subjects while almost entirely neglecting others "of equal interest, importance and ripeness for development."

Specialists today are eager to jump on the bandwagon, aided by grant funds, asserts Platt. He points to the reported 400 government and industrial projects dealing with the optical laser, representing several thousand scientists and engineers.

"The motorcar was developed with less than 40 manufacturing and development teams. One can't help wondering whether everything important to discover in the field of lasers might not have been discovered just as fast with only 40 projects."

"We develop some things well and others not at all. Why shouldn't someone "make up a single suit that would shed rain and that we could ruffle up for comfort in any weather, as a bird ruffles its feathers? A bird needs no suitcase."

"Scientists are not really innovators, and neither are industrial companies and government agencies and their research-development teams.

"We seem to have collective taboos against certain types of development, like the taboo against work on oral contraceptives before

1950, or the refusal to consider Buckminster Fuller's geodesic dome buildings until the Army use the principle for radomes."

Platt points to many neglected research areas:

—Regeneration. Lower animals can regenerate parts of their bodies, some even the eyes and optic nerves. A study of "tissue inducers" or the restoration of embryonic biochemistry might permit a useful measure of regeneration for man. "We'll never know if man can grow not merely skin over a stump, but bones and muscles, until a few dozen scientists get to work on it."

—Rejuvenation. Can man preserve or restore sexual activity and enjoyment after age 50 or more? With 20 per cent of the people of the world in this age group, it "is a problem affecting the health and marital happiness of more than 600 million persons." Could genetic processes aging be reversed or delayed?

—Biological experiments, like inserting the nucleus from an adult cell into a fertilized egg cell in place of the egg's own nucleus, to produce an identical twin. It could be basis for a new animal-copying industry, method for stock breeding, potential for childless couples to have genetic copies of husband or wife. Even, perhaps, paleo-reconstruction of ancient animals and plants.

—Biological technology, experiments for selective breeding and herding of sea animals, farming the oceans. Experiments on animal development, to make larger brains, stronger muscles, better pets or seeing-eye dogs for the blind.

—Devising sophisticated machines that would serve biological functions like balancing machines, to help the paralyzed to walk. "Should these be so hard to devise, for men whose electric circuits have flown past Mars transmitting pictures? The amount of scientific, engineering effort devoted by the nation to such problems is probably less than a ten-thousandth of the space effort."

—Self-guiding automata, artificial cybernetic organisms or 'cyborgs' with pattern-perceiving sensory systems, communications systems and control programs.

—More diversity and technological development in home construction, patterns of house-lot arrangement.

"Why shouldn't our magnificient economic and social system be able to give us a level of technological skill and competitive cost in house construction of our homes that is similar to the level of research and production for our automobiles?

"One begins to wonder, whether our conventional pattern of life today, with its separate households and its separate age groups, is really giving us the full satisfactions of human living," Platt says. "Why shouldn't we make environments where we can have diversity and human satisfaction and pleasure of living all year round, instead of just in a student community or a wartime colony, or a summer laboratory?"

U.P.I.

The slowly sinking tower, now 14 feet out of line, may have a great fall in 80 years.

Can we save the falling tower?

by Ted Roberts

THE leaning tower of Pisa in Tuscany, Italy, has stood in apparent defiance of the laws of gravity for longer than seven and a half centuries. But the tower, one of the world's most famous landmarks, is engaged in a race against death. Scientists believe that unless a way is found to stop the gradually sinking tower, it will crumble in less than eighty years.

Italian scientists, frantic over the future of the tower, hover over the architectural invalid, recording its pains and stresses.

Since 1911, every June 19, at five o'clock in the morning, a professor from the University of Pisa visits the bell house and measures the increase of the slant with special instruments. And every year the professor intones the same sad report: . . . the tower has leaned a fraction of an inch more. Last year, the 175 foot-high tower was leaning over at an incredible fourteen feet and ten inches out of the perpendicular.

How did the Tower come to lean in the first place? In the 12th Century, the citizens of Pisa resolved that their Cathedral should have a campanile that would outshine the bell tower built for St. Mark's, completed in 1515. After the foundations were dug, Bonanno, the first of four architects to work on the tower, laid the initial stone in 1174.

But before it had risen forty feet, the Tower began to sag noticeably. In 1234 Benenato, a high Cathedral official, was asked to complete the

U.P.I.

The bottom of the tower was fenced off from the view of tourists early in 1966 while technicians, surrounded by cables and machinery, studied ground around monument.

Tower; he finished the fourth arcade and then quit. Another architect, William of Innsbruck, then took over. Boldly, he attempted to bring the tower back on course by making the pillars in the fifth and sixth balconies longer on one side than on the other. But the foundations continued to sink.

Almost a hundred years later, Tommaso Pisano completed the sixth and last balcony; the belfry was built closer to the center of gravity and the ill-fated campanile was at last finished in 1350.

The tower has been the pride of the city of Pisa since it was completed. There are seven bells atop the tower with a combined weight of about 29 tons. The bells once rang out over the city. But in 1959, the scientists forbade the ringing, to prevent any vibration that might aggravate the tower's lean. Trucks are not allowed to pass in the vicinity of the tower for this same reason, and the rattling motor scooter . . . a universal noise in Italy . . . is not heard where the tower leans so perilously.

According to the Italian Ministry of Public Works, the real explanation of the tilt lies not in the builder's eccentricity, but in the subsoil of Pisa which is a sponge of alluvial clay and sand and is 60 percent water. In fact the foundation is in an old lagoon in which tide lines can be traced.

Italian authorities are feverishly trying to find a way to save it, since a violent earth tremor could jar the

foundation loose. Over the years, attempts have been made to straighten the tower. The latest and most imaginative effort occurred in 1962, when a group of tourists ran a steel cable around the base of the tower, attached it to the rear bumper of their automobile, then accelerated at top speed. Result: one lost bumper; one firm tower.

According to the ministry of Public Works in Rome, two survival plans are now being considered. One calls for the stone by stone dismantling of the Tower and its rebuilding on its present spot, with a new, immobile concrete base that would resist the treacherous soil.

As they have been doing for a long long time, plans to save the Tower of Pisa are still coming into the Ministry of Works in Rome. Most of them, strangely enough, come from the United States.

Upright solutions

An electrical engineer from Harrisville, Missouri, thinks the tower could be straightened, or at least kept from increasing its lean, simply by lining it with steel and placing giant magnets on a trellis tower outside. A builder in Massachusetts writes that he has tackled the problem of leaning chimney stacks all his life and he figures that they always tend to bend away from the prevailing winds. Twist the tower of Pisa around on its base and it will start correcting itself, is his solution.

Professor Yao Tee-Li of M.I.T. sounds more plausible with his submitted plan to construct a steel cage inside the tower and anchor it, by means of cables under tension, to a giant block of concrete placed close to the base.

While waiting for the Ministry of Public Works to make a final decision over the many schemes that have been submitted as a means of saving the Tower, Professor Colonnetti of Italy has drafted a plan which should temporarily halt the continuous sinking of the tower.

This plan contemplates the use of a machine built by the Fiat company for the salvage of the temples at Abu Simbel. It is a machine that is both extremely delicate and powerful and consists of a mechanically controlled hydraulic jack which can lift 700 tons. Assembled on independent foundations on the south side of the Tower, it could be used to stop sinking by means of a lever running through an opening in the edifice.

The idea is not to straighten the tower but to reinforce it so that it may continue to lean with safety.

As the experts ponder, tourists continue to flock to the tower at the rate of about 400,000 every year, to view and climb Pisa's pride. This may be the reason tourist-officials in Pisa do not relish the thought of changing the tower. If the tower is straightened they feel, and the trademen agree with them, tourists might cease going to Pisa.

Of legends there are many, but only one mystery: How long will the tower of Pisa continue to defy the laws of gravity?

Young Benedictine monks undergo group analysis in a Mexican monastery. Psychiatrist is Frida Zmud, who probably knows more monk secrets than any woman alive. Abbey's leader, Dom Gregoire, insists that the analysis purifies and permits religious belief.

Tell your troubles to the group

by Flora Rheta Schreiber and Melvin Herman

"JOE" was what is known as a "sadomasochistic patient." In general this means that besides harboring a highly hostile mean streak, he was self-destructive. Under three different therapists he had tortured himself by self-induced failure and defeat with grotesque regularity. Specifically, he punished himself by perpetuating a tough domestic situation until it became obvious to everyone concerned that the mistreatment he groaned about was self-inflicted. Joe's wife was a nymphomaniac, but he did nothing to end a miserable relationship. Maybe. the doctors suggested, she was handy to have around for abuse.

Even with this point established, the patient did not respond. The outlook, one of his therapists reported, was one of "prognostic

gloom and therapeutic despair." After careful consultation, he was transferred to a "group" unit. In such therapy, usually six to eight patients under the guidance of a psychiatrist are encouraged to interact; to hash out their problems in consort or conflict. Sometimes, this interplay shakes a patient into taking a good honest look at himself. Joe's first reaction to the group was to jeer at his colleagues and try to enrage someone to the point of bashing in his head. Or, he'd try to get someone to talk to the therapist in a hostile way. It was, of course, *Joe's* hostility. He was hiding behind the other patient. After other members started ganging up on him, Joe began to examine what was happening when he attempted to lure fellow members into clashes. He finally was able to work *with* the group to his therapeutic advantage.

In Joe's case, group therapy undoubtedly rescued him. Therapists admit it is hard to tell how a patient will react to a group before he begins. Sometimes the most unlikely candidates do best. One young lawyer, who arrived late for his first group meeting, took the most distant seat and scowled at his confreres. He'd been depressed for months. During that time he never smiled, rarely talked, and functioned inadequately in his work. Before the first session was over, he was joking and laughing heartily. Conversely, another patient who approached his first group session in a state of elation, wound up thoughtful and silent throughout.

Once suspect as being merely watered-down individual analysis, group therapy during the past decade or more has earned a hard-won place in the sun. It is most often used alone, but when used concurrently with individual therapy, it gives the patient another look at his therapist. This new view often results in a challenge to the good doctor's infallibility and an end to the patient's expectation of magic.

No close relationships

Not everything is sweetness and light. Detractors maintain that it is impossible in group work to obtain the close doctor-patient relationships that develop in a one-to-one situation. It is this very intense personal relationship, they say, that is necessary to successful therapy. Critics also believe that the group structure brings about conformity in the patients. As proof, they cite studies when group members, arranged for research purposes, agreed with incorrect judgements rather than defy the group. As is typical in research projects of this sort, everybody is in on the "gag" except one person. They take a false position and he either argues or agrees. In practically every instance, they point out, the victim gives in to the group. The question they raise, is whether the time spent in group work represents the most profitable investment

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Miss Schreiber is an award-winning writer on psychiatry; Herman, the Executive Secretary of the National Association of Private Psychiatric Hospitals.

of therapeutic time.

"The group" is thought by many to be a recent development, but its literature dates back to the last century, and there was a small but active number of group therapists in the early years of this century.

In the thirties, Dr. Louis Wender, for one, was holding group sessions regularly. While he stressed individual therapy with his hospital patients, he still found it beneficial to meet twice a week with a small group. His method was to open the session by talking informally about such subjects as the unconscious, dreams, early traumatic experiences, or repression. "Where resistance is high," he said, "a theoretical discussion is safe and covers the same ground." He was particularly skilled at devising hypothetical case histories to present to the group which were really drawn from members of the group who usually did not recognize their own problems. Therefore they were freer with their opinions and suggested solutions to problems they had never been able to face before.

Groups of eight

Groups can be large or small, but eight seems to be the preferred number. It allows for dropouts and for everyone to talk within the customary hour or hour-and-a-half. Most groups meet twice a week. Many go on indefinitely until a therapeutic goal is reached. The imposition of a deadline creates a detrimental state of binding anxiety in some of the patients.

Group therapists don't agree on therapy approaches any more than therapists in individual therapy, but there seems to be general accord that group members should not be chosen because of similarity of symptoms but at random.

Generally there is one therapist, but some groups use two, one of whom may be a sort of junior partner. Still other groups are leaderless. With a leaderless group, the therapist may be one of the gang, or observe only through a one-way vision mirror. Dr. W. R. Bion, one of the foremost experimenters in small group dynamics, is an exponent of this technique. His studies of small groups resulted in many of the theories used in training groups in industry. (See *Science Digest,* April 1966.)

Some groups use paintings, puppets, music or even charades to evoke reactions.

There are many different methods used. Some say as many as there are therapists. At one end of the treatment spectrum is the psychoanalytically oriented group, at the other end perhaps such groups as Alcoholics Anonymous which rely on repressing symptoms and whose role is frankly educational.

Dr. Eric Berne, whose book, *Games People Play,* is a current best seller, is an advocate of a form of therapy he calls "transactional analysis," which deals with acts as they occur in the course of the session. This runs counter to other therapists who regard the group as

an entity which transcends the sum of its members, and feel that the therapy should be directed to the group as a whole.

Dr. Berne prefers the term group by the attitude of the therapist. He says in his new book *Principles of Group Treatment*, some groups are more interested in group action while he believes the main goal must always be alleviation of the individual patient's problem.

Dr. Berne likes to classify groups by the attitude of the therapists. He warns that the therapist must be certain why he has selected group rather than individual therapy for his patient or patients. "The doctor must ask himself what game am I playing?"

Doubtful value?

He must also, as Dr. Berne discovered in his work with a group of alcoholics, ask "What game is my patient playing?" His group members were much more reluctant to talk about themselves than their drinking. "It is very doubtful," Dr. Berne said, "that an alcoholic has ever been cured by repeatedly discussing his wife's behavior."

However, he cautions against setting rules. Each group member must feel free to say whatever comes to him. The very rules set by or for the group can serve as the fulcrum for individual rebellion to it.

No two groups are ever the same. The therapist must be prepared for these differences. There is, says Dr. Berne, the sophisticated patient seasoned in therapy who need only be told that participation in the group will give his therapist a chance to get "first hand rather than second hand information about the patient's proclivities." Skeptical patients may have been dissuaded by seeing group therapy on television or by having read about it in books. The too-receptive patient must be made to understand that group therapy is not meant for kicks, but is a serious procedure. The group-shy patient must be made to function as a member, and the unready patient must be fully prepared for possible fireworks. Most of all the therapist must be skilled. One can't walk in and take over group therapy and treatment. It is not enough to be familiar with psychotherapy. A knowledge of group dynamics and experience with groups are essential. The therapist must face the fact that there is always a possibility of damaging a patient by misleading him, of opening new areas of pathology without proper preparation.

But man functions in groups in just about everything he does. Some say the group the man belongs to in life actually makes the man.

The function of group therapy that Dr. Berne casts aside, that of the group as a whole, has its own

staunch proponents. As a result of therapy groups, some hospitals have changed treatment from custodial care to active therapy. In England perhaps more than in the United States the group therapy method has been tried to change entire community attitudes.

What can group therapy offer the patient? Ideally, the answer is some reorganization of his personality, help with his symptoms, greater satisfaction in social life, and an increased control of his behavior.

Dr. Berne points out that each goal is distinctly different and must be kept so by the therapist to avoid fuzzy thinking.

Now, when the age of anxiety has become the age of violence, the therapist working with groups finds that the kinds of patient activity provoking greatest anxiety are gross manifestations of violence and sexuality. What is socially unacceptable behavior is often labeled "acting out."

Group therapy or treatment provides the perfect state for this performance.

Group therapy, which began when certain medical practioners searched for a way to influence their diabetic and tubercular patients to follow the routines necessary for the control of their illness, now operates on an infinitely larger canvas. "Today it is recognized," says Dr. Alexander Wolf, co-author of *Psychoanalysis in Groups*, "that isolation entrenches illness, that it forces the patient to project and populate his environment, even to hallucinate. We know that to prevent or cure mental illness we must get the patient into life, into the family, into school, profession and community; that by increasing his contacts with reality rather than by isolation, we take the patient away from subjective irrationality."

Group therapy can be a bulwark against irrationality-producing isolation.

"In your case, I think we'd better try the last resort first."

Tips and Trends

Venereal disease rates are climbing again in this country, according to a sobering report filed by state health departments. From a low of 197.8 cases per 100,000 population in 1958 (after the advent of penicillin), the rate has climbed steadily to a current 230.7 cases per 100,000. The reasons: reticence, false confidence in "cures" and ignorance -- plus new, resistent strains of bacteria, according to The Merke manual.

Engineering demand will exceed supply for ten years according to a report from the Engineering Manpower Commission. An estimated 830,000 college graduate engineers will be needed between now and 1976, while only 500,000 will be available.

A spray-on coating you can eat will preserve food before long, says the U.S. Department of Agriculture. The thin film is a fat base that locks out oxygen and seals in quality. Nuts, for instance, will stay as fresh as they do in plastic bags. Poultry and fish do equally well. The coating can be eaten or removed by hot running water.

Chronic respiratory diseases claim 83,000 lives a year -- more than 90 percent of them in persons over 45 years of age, according to Metropolitan Life's mortality tables. The rate has risen 12 percent over the past 14 year period.

An earthquake analysis network for future forecast is now operating around the world. Set up by the U.S. Department of Commerce's ESSA, 68 stations report temblors from such far points as Antarctica, Greenland, Fiji, Congo, Asia, Eastern Europe, to name a few. Cooperating nations receive an analytical report of worldwide patterns each month. From these, forecasts may soon be possible.

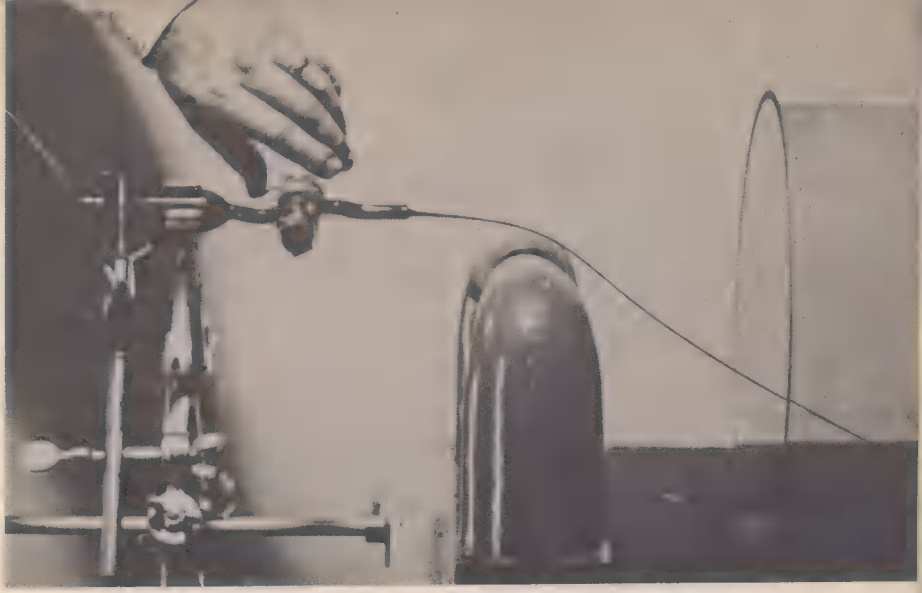
Irradiated foods may hit supermarkets in 2-5 years according to research scientists. Bacon, wheat, wheat flour and white potatoes already have been given the go-ahead by the FDA.

NEW FOR INDUSTRY

A computer technique for designing and drafting auto tires is capable of producing drawings for a new line of tires in about 18 hours. Hand drafting time is four to six weeks. In above photo automated drafting machine is drawing a tire mold design.

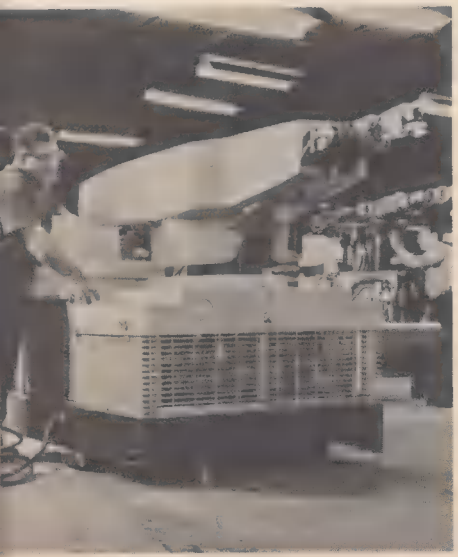
A stainless steel culvert designed specifically to survive severe attacks from corrosion and abrasion has been fabricated by Allegheny Ludlum Steel Corp, Pittsburgh.

Simple phone test for computers is being used by IBM customer engineers. Engineer dials number and answering device transmits two minute recorded test message.



Flow of magnetic fluid is deflected by an ordinary magnet. Fluid consists of colloidal suspension of sub-micron-sized ferromagnetic particles in fluid carrier. Applications of the ferro fluid include the development of an accelerometer sensor for the Air Force.

The U. S. robot population will be at least 5,000 by 1972 says Unimatron Inc. a builder of industrial robots which announced a five-fold increase in production.



An oven, heated by quartz infrared lamps has been designed to warm-up ore-carrying railroad cars. During winter cars often can't unload because ore freezes to sides.

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I prescribe . . . for ulcers and indigestion

by Joseph D. Wassersug, M.D.

INDIGESTION means so many different things to so many different people that its exact definition is impossible. For some, indigestion means heartburn; for others its "a cold in my system." Indigestion may refer to the severe pain of obstruction of the bowel or perforation of the stomach or just the nagging leaden heaviness of constipation or the gnawing discomfort of hunger.

Good digestion depends on not only wholesome food but also on a pleasant setting. If a husband or wife are angry with each other or give each other the silent treatment both may suffer from indigestion. In some countries the noonday meal is followed by a siesta to promote relaxation. Traditionally, candlelight, wine and music relax the nerves and relax the stomach. When a man has indigestion, therefore, it may not be due to unwholesome food but a disturbing environment.

In brief, uncomfortable symptoms of indigestion more often depend on what is eating you rather than on what you are eating. Frustrations in work, an argument with the boss, an unhappy experience before dinner may freeze the digestive juices. I emphasize this point because so many patients in my office ask questions about diet, indicating little or no concern and no understanding about the disturbing emotional factors in their life.

Although the basic cause (or causes) of ulcers is still disputed, doctors know it is somehow related to excess acidity of the stomach juice. Relief of ulcer discomfort depends, then, on cutting down the acid secretion of the stomach or neutralizing it.

The average ulcer patient learns from experience that chewing a few antacid tablets help and so he chews them intermittently without ever really getting over his symptoms or ever curing his disease.

To cut down acid formation, I use tincture of belladonna or one of the many drugs that have a belladonna or atropine-like effect. These drugs, in varying degrees, all block acid formation in the stomach. I use these drugs freely and in large enough doses to do the job. I think they are more important than antacids. Sometimes the dose has to be pushed till side-effects such as dryness of the mouth or blurring of the vision occurs. I tell my patients about these possible side-effects so that they won't be alarmed if they occur.

Antacid action

Antacids are valuable if they are used properly. Until a few months ago I advised that they had best be taken right after eating. Recently, however, a careful study (reported in the New England *Journal of Medicine*) disclosed that in ulcer patients the stomach has a very short emptying time after eating. This means that antacids put into the stomach right after a meal do not remain there long enough for effective acid neutralization. According to this report antacids work better when used an hour or so after meals. Constant neutralization of acids is the ideal goal.

The simplest antacid is baking soda (sodium bicarbonate) but it is not the most effective. Furthermore its use is often accompanied by an "acid rebound," that may aggravate the indigestion. Ordinary chalk (calcium carbonate) is a good acid neutralizer but too much calcium is not good for the system.

The most widely used antacids today contain aluminum hydroxide gels or some similar preparations. Since they may be constipating they are often combined with mild laxatives such as milk of magnesia or magnesium trisilicate. In treating ulcers I use many of the different products that are currently available. I find it most difficult in practice to prove that one product is really better than another. I often give the patient a few different samples and let him decide on the basis of taste and palatability. The better the medicine tastes, the more likely the patient is to stay with it.

Does the ulcer victim also need some sedative or tranquilizers? Some doctors say no but I think that most patients do better if they are calmer. Many ulcer remedies contain both acid depressants and sedatives (or tranquilizers) and I usually prescribe such combinations rather than the acid inhibitors alone. I make exceptions to this practice if the patient complains about feeling "dopey" or is emotionally depressed.

Most important, I urge ulcer patients to stay with their medical program, until they are really better. Ulcers tend to recur. I try to emphasize the point that the care of an ulcer is a lifetime job. Occasional dietary indiscretion and emotional upheavals may do no harm. But if they are part of a way of life it may be disastrous.

Let me say a few words now

Ulcers tend to recur, and the proper care of an ulcer calls for a major change in the patient's way of life.

about three other troublesome gastrointestinal conditions; diverticulosis, colitis, hiatus hernia.

First, *diverticulitis* must be distinquished from *diverticulosis*. The word *diverticulum* refers to a little pouch or a little outpocketing of the bowel, usually the large bowel. Diverticulosis usually means that there are many such little pockets. Many people over 35 have diverticulosis; practically everybody over 65 has it. In most cases diverticulosis is discovered by X-ray examination and can safely be ignored. It causes no symptoms and is harmless.

Diverticulitis means that the *diverticulum* is inflamed. Here the symptoms may resemble those of appendicitis or even cancer of the bowel. If the condition is old and chronic it may cause bowel obstruction that requires major surgery for its relief. In mild cases antibiotics and adequate fluids may reduce the inflammation and restore health.

Most doctors still prescribe a soft-solid, low-roughage diet for simple cases of diverticulitis. After thirty years of practice I am still not sure that the dietary approach is necessary or even sensible. I let my patients eat what they will and exclude only those items from the diet that they have learned from experience cause distress.

Hiatus hernia refers to a rupture in the diaphragm that enables the stomach to slip upward from the abdominal cavity into the chest cavity. The rupture may be tiny or it may be large. There may be no symptoms at all or distressing indigestion (worse on lying down than standing up) depending on the size of the hernia and other factors. In most cases the hiatus hernia is nothing to worry about and no special treatment is necessary.

There are many kinds of *colitis* but the two most common are spastic and ulcerative. Although they are both called "colitis" they probably have nothing in common.

Spastic colitis is, most often, due to nervousness and is best treated by reassurance and nerve pills.

Ulcerative colitis is often a severe, disabling, progressive disease that starts with intractable diarrhea and leads to ulcerations in the bowel. The exact cause of ulcerative colitis is still not known but doctors have incriminated almost all possible factors such as nerves, germs, food intolerance, allergies. Accordingly, the patient with ulcerative colitis may have to be treated with special diets, psychiatry, surgery, transfusions, antibiotics and whatever else seems appropriate at the time. In problem cases I prefer to have the patient in a large, well-staffed, metropolitan hospital.

A common cause of indigestion is chronic constipation. This usually starts in early adult life and is often due to a faulty bowel habit, to a

neglect of nature's normal signals.

Whereas constipation may be a chronic problem, diarrhea is usually an intermittent event causing only irregular bouts of indigestion. Commonly diarrhea is due to some food intolerance or to the contamination of food by some germ or parasite.

Not commonly recognized is the fact that milk and milk products can cause diarrhea in some persons. To digest milk sugar properly (lactose), one needs certain special enzymes in the bowel. Most persons have these enzymes but some do not. If the proper enzymes are lacking, the patient may suffer from diarrhea every time he drinks milk or eats cheese or ice cream.

Offending foods

Other people have intestines that cannot handle *gluten,* a protein in wheat bread. Still others are intolerant of certain carbohydrates. Some cannot properly digest all fats. In these cases indigestion and diarrhea may be the prominent symptoms and may go inadequately treated until the offending food is discovered.

Various germs can cause diarrhea and indigestion of mild to extreme severity. Which germs may be your worst enemy will depend on what part of the world you live in or where you have travelled. There are bacillary dysenteries and amebic dysenteries; there are typhoid, typhus and cholera. There are parasitic infections like hookworm.

In our country the *salmonella* germs are perhaps the most common invaders. *Salmonellosis* is usually milder than the severe exotic dysenteries but can leave the patient quite sick and feeble for a few weeks. I used to treat most cases of salmonella infection symptomatically (paregoric and pectin preparations) until I read some recent encouraging reports in medical journals that these infections could better be treated with *ampicillin,* a penicillin derivative.

In the symptomatic treatment of diarrhea I try to do two things—relieve the indigestion and reduce the frequency of the bowel movements. Paregoric is one of the useful medicines. I generally advise my patients to take one or two teaspoonsful right away and then take one teaspoonful after each bowel movement but not more than six or eight teaspoonsful in any twenty-four hour period. Paregoric is an opium derivative and should be used with caution. In practice, however, I find that most patients actually take too little to help.

Another medicine of value is belladonna and the many drugs that have a belladonna-like action. These drugs tend to depress the contractility of bowel. They may be prescribed alone or in combination with phenobarbital or other sedatives. In mild cases they are all the patient might need.

Kaolin and pectin combinations are widely used but they are not as helpful as the average layman might be led to believe. For one thing the average layman ignores the in-

structions on the label or never bothers to read them at all. It is my impression that no matter what the label reads, the layman takes one teaspoonful. When it comes to kaolin and pectin, however, the average dose of the most popular product is about four tablespoonsful! And even that is a mild dose.

Serious cases of diarrhea may need to be treated with such antibiotics as streptomycin, neomycin, cephalothalin, kanamycin and others. Intravenous fluids may be necessary to restore water balance. Potassium dosage may have to be adjusted. When patients are that ill, I treat them in the hospital, not at home.

Although I have mentioned both constipation and diarrhea as separate entities I must add a word of caution at this point. Any change in usual bowel habit may be significant, may indicate the presence of a growth or tumor.

If my patients do not respond to conservative treatment in a week or two I order bowel X rays, stomach X rays and sigmoidoscopic examinations. Sometimes, if I am not entirely satisfied with one such work-up, I repeat the tests in a few weeks.

Although there are many digestive disorders that are still not completely understood, about one point I am certain. The doctor must always listen carefully to the patient's complaints of indigestion. He must seriously evaluate the trouble, and must do his best to eradicate the cause as thoroughly and permanently as possible.

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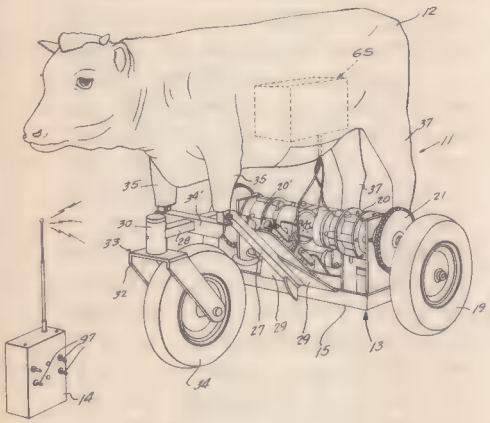
The Mechanical Calf



Numbered drawing of mechanical cutting calf is part of Harris' patent application.

A recently patented mechanical calf starts, stops and turns right or left in response to radio signals. No toy, the life-sized animal looks like a real 600-pound calf, and is used in training ranch horses to herd cattle.

Appropriately, the motorized calf was invented in Texas and is produced there. The H. & M. Manufacturing Company of Brenham reports that it has made and placed about 100 in some 40 states, besides Canada.

Patent description

As described in Patent 3,303,821, the calf is carried on three rubber-tired wheels. Each of the two in the rear has its own reversible motor. The front wheel, above which the calf's forelegs are mounted, is attached to the frame by a bar and swings on a swivel.

Current for the motors is supplied by a pair of series-connected, six-volt batteries.

The receiver is in the calf's belly, and the transmitter may be some distance away in the field. By modulating the signal, the operator can start one or both motors. To make the calf turn, he reverses the left or right wheel.

The calf's originator, and *Science Digest* Inventor of the Month, is Lee R. Harris, one of the owners of the H. & M. Company. His patent calls it a mechanical cutting calf. The word "cutting" refers to the practice of cutting an animal out of a herd.

According to cow country sources, the rider of a horse that is sufficiently trained can direct his attention to the animal that is to be separated, and let the reins fall.

Besides appealing to ranch owners, the mechanical calf is expected to find a market with those who train horses for rodeos and others who do it merely as a hobby. The patent describes it as durable and reliable, and as considerably reducing the cost of training because it does not have to be fed.

The patented calf is literally dumb, as Mr. Lee has not provided it with any means of bawling, but its motors are said to produce a distinctive whine.

Stacy V. Jones

Dr. Proctor P. Disbro demonstrates on "victim" simple RES-Q-AIRE operation.

Breath of life

A green accordian-pleated apparatus called Res-Q-Aire could save your life if you've been overcome by smoke, come close to drowning or are victim of stroke.

Invented by Dr. Proctor P. Disbro, a prominent Cleveland physician and surgeon, the respirator is supposed to bridge the gap between respiratory failure and the arrival of medical aid. The doctor got the idea from the bellows-like construction of one of his children's toys.

The hollow bellows delivers 1100 cc's of air, an amount comparable to a deep breath. The amount is the same every time because the dynamics of its design ensures a built-in time return. In addition, the operator doesn't have to count or watch a clock. The mouthpiece, which is pressed down on the tongue, is short enough to fit safely in the mouth of a premature infant. A simple disk valve is built inside the piece to prevent air in the patient's lungs from reentering the bellows. The mouth shield placed against the victim's lips, is released about a quarter of an inch after each delivery to allow air from the lungs to escape.

Res-Q-Aire is portable, weighing only nine ounces and made of lightweight polyethylene, so that it's easy to handle for extended periods of time.

The artificial respirator is preferable to mouth-to-mouth resuscitation, says Dr. Disbro because: It delivers fresh air, not carbon dioxide; the operator can pump evenly in adequate amounts for several hours without the fatigue and bruised lips that accompany mouth-to-mouth or mouth-to-nose respiration; it's more hygienic; after washed with soap and water, it can be used again and again.

Res-Q-Aire sells for $12.50 and will soon be available nationwide.

Vandals beware

Any high school kid who tries to vent his hostilities on school property may soon find himself bombarded with lights, alarms and some surprises thrown in by the police who are monitoring the school building.

A warning system to protect

Vandal alert signals monitoring policeman.

against vandalism has been developed by Dukane Corp. It works by converting classroom loudspeakers into sensitive microphones which pick up any odd noises around the school buildings. If the noise is steady or if three alarm signals are pulsed out in a given span of time, a warning light flashes on a monitor panel. The police or school personnel who are acting guardians of school gates can tune in to the disturbed area by pushing a button on the panel. Measures can then be taken as needed.

The difference between this alarm system and previous devices is that this one can distinguish between normal noises and unusual sounds. To prevent false alarms, impulses from outdoor sounds of thunder, air or road traffic or interior noises of building utilities are picked up by microphones and fed into a lock-out circuit. In addition, a computer checks the frequency and continuity of alarm impulses before activating the monitor panel.

Rubber undersea

In the sea, Earth's last frontier, where movements are heavy-footed and visibility is restricted, rubber may prove the only feasible answer to the problems of underwater research, according to John T. Reynolds, manager of marine products for Goodyear Tire and Rubber Co. Light-weight rubber is replacing the heavy steel and fabric diving suits and rubber covers are improving efficiency of electronic probing devices.

Marine sonar equipment, which "reads" the size, shape and location of undersea objects by bouncing sound signals off them, can be designed with rubber housings to protect the detection instruments while allowing them to operate at maximum efficiency. Underwater microphones, for instance, must be insulated against water and physical abuse, but must be able to receive distortion-free sound waves. Certain types of rubber are durable enough to withstand water pressures and have sound transmission characteristics nearly equal to that of sea water.

Hose-like housings made of rubber can be used for towed sonar arrays and for fibration isolators to protect towed equipment from undesirable noises from the mother ship.

Anti-foulant paint using a rubber base can be used on ship hulls, propellers and rudders, buoys, communications cables and even dock piers, reducing cost of protecting

these undersea structures and extending the life of coatings already in use.

Underwater storage of fuel is now possible through the use of large rubber containers that have capacities up to 100,000 gallons.

A possibility for future long-term projects are rubberized fabric shelters that could house men and equipment under water.

Danger signal

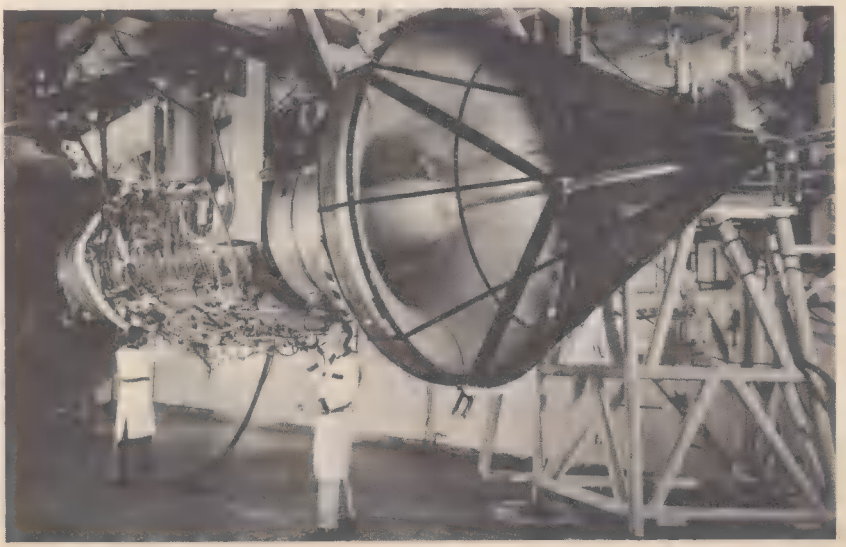
A portable device to warn workers in nuclear industries when the radiation level has reached the danger point has been developed at Ohio State University's Nuclear Reactor Laboratory.

Assorted radiation monitors have been used before, but they have either been permanent fixtures in the lab, too cumbersome for the worker to carry or couldn't give immediate feedback. A personal radiation monitor has been a problem in the nuclear industry since the outset, asserts designer Richard W. Bailey. People working where there are nuclear reactors, particle accelerators or X-ray machines or where radioisotopes are used are in danger of getting an overdose of radiation.

Powered by a 1½ volt penlite battery, the nine-ounce device is compact enough to be worn on the

Supersonic Transport Unveiled

This 25-foot-long GE4 turbo jet engine is the prototype for the planned supersonic transport. These planes, long as a football field and flying three times the speed of sound, need an engine with 60,000 pounds of thrust which is about four times the power of today's commercial jets. The engine is produced by General Electric's Flight Propulsion Division.



pocket or belt of the worker. As the radiation level goes up, the normal steady clicking noises pop faster and faster, giving the wearer immediate warning.

Only five instruments are available but they are all on the Ohio State U. campus. No plans have yet been made to produce them on a mass basis but it is estimated that they could be produced in groups of 25 at 34¢ each.

Quick blood analysis

Drop-size samples of blood can now be tested efficiently on a routine basis with new micro devices collectively called the Beckman Ultramicro Analytical System.

A self-contained clinical laboratory, the system features four instruments: the Spectro Colorimeter which measures the blood sample; the Microfuge which spins blood solids and separates them in seconds; the Microtitrator with an adjustable vibration stirrer built on; and the Micro-mixer for thorough mixing of solutions.

The secret of the system is the new polyethylene Micropipette. Fitted to a squeeze bottle, the micropipette is virtually self-measuring, a boon to the operator and one reason for the system's accuracy. Reproducibility is equal to conventional methods because the same micropipetes and bottles are always used for the same measurements in a series of tests.

Washing is kept to a minimum. Reagents are stored in pipette bottles; micropipettes are polyethylene and do not retain liquid film. Titration cups and centrifuge test tubes are disposable.

Computer quantum cartoons

The mystery of quantum physics is being translated into cartoons by two MIT scientists. They are using animated film techniques to make the concepts of quantum physics more intelligible to the student physicist.

Instead of a cartoonist, however, the animator is a computer which, in one second, performs complex equations and draws the results on a cathode-ray tube display. It would take a human cartoonist half an hour of hard labor to produce the same thing.

The computer-generated film, "Scattering in One Dimension," deals with the peculiar oscillations of a wave representing a beam of particles as it confronts a force field—the phenomenon of scattering—one of the most important experimental techniques in modern physics.

The new technique is one of many educational experiments using computers being tried at the MIT Education Laboratory. Though not likely to be seen at the friendly neighborhood theater, the film, according to Dr. Harry M. Schey, one of three co-developers of the technique, helps students to visualize physical concepts that are outside ordinary experience. The MIT group has so far completed three films and has six more in the making.

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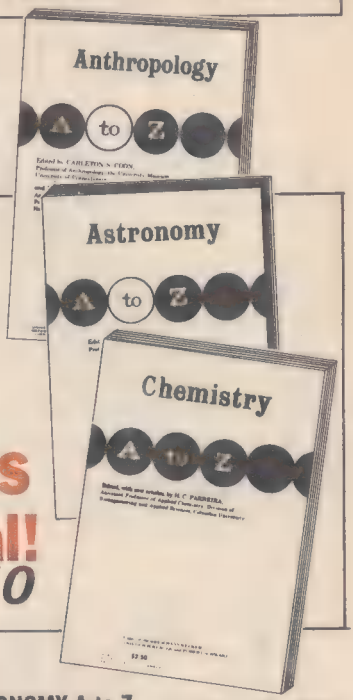

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Run for your Life

by Arthur J. Snider

Down neighborhood streets, in parks and playgrounds, over the open road and on high school and college tracks middle-aged men, sedentary professional and housewives are running for their lives.

An increasing number of physicians is becoming aware of what athletic directors have been insisting for years: The heart, like any muscle of the body, can be strengthened by daily, vigorous use and weakened by inactivity.

The new interest in exercise began just after World War II when concern mounted over the "flab gap" uncovered during the war. The President's Council on Physical Fitness was organized to tone up the nation's muscles.

Several investigators, suspecting the rising incidence of heart disease was linked to the growth of automation and labor-saving devices, began to think seriously about funneling some of the ardor for exercise into heart-disease research. They began laboratory and clinical experiments.

"Reports of interesting research now going on lend further support to the hypothesis that physical activity can desirably affect serum cholesterol levels," comments Dr. Fred V. Hein, secretary of the American Medical Assn. committee on the medical aspects of sports.

Cholesterol level in the blood serum is considered by most authorities to be related to the risk of heart attacks.

Several medical men contend that a diet low in cholesterol will reduce the risk. Others contend this has not been proven.

"The tentative conclusion can be drawn that exercise is one of several significant factors involved in maintaining blood cholesterol levels within limits generally considered normal," Hein adds.

His opinion is supported by Dr. Wilhelm Raab, director of the cardiovascular unit at the University of Vermont.

"If exercise does not prevent coronary disease, it certainly delays the onset and develops collateral (auxiliary) circulation. A man who might have a myocardial infarction (a heart attack with muscle damage), may instead develop angina."

Some of the first studies to be reported compared the incidence of heart attack among active and

sedentary workers. One that attracted wide attention was conducted among 31,000 transportation employes, age 35 to 64, in London by Dr. Jeremy N. Morris. He found that conductors, who constantly traveled up and down the stairs of double-decked buses, had a heart-attack rate half that of bus drivers.

Morris then compared sedentary postal clerks with postmen who walked most of the day—a total of 110,000 subjects—and found similar results. Later he analyzed 4,000 autopsies of individuals who did not die of heart disease and checked them against occupations.

Heart disease ratio

Hearts of those involved in more strenuous physical labor showed less scarring than among men in sedentary occupations.

In the United States Dr. Henry Taylor investigated the relationship of physical activity and coronary heart disease among 40-to-64 year old railroad workers.

The age-adjusted death rate for arteriosclerotic heart disease was 5.7 per thousand for sedentary clerks, 3.9 for moderately active switchmen and 2.9 for section workers involved in heavy activity.

Several other population studies, along with laboratory findings, have shown similar results.

But there are two notable exceptions. A study among Los Angeles civil service employes, divided into four classes according to physical activity, showed no significant difference in heart attack rate.

Similarly, Dr. Jeremiah Stamler, head of the heart disease control program in the Chicago health department, found approximately the same incidence rates among the sedentary and active workers in a Chicago utility.

Stamler concedes, however, it is "quite possible that lack of large-muscle exercise acts synergistically with habitual high intake of saturated fat and cholesterol, cigaret consumption, high blood pressure, diabetes and other risk factors."

"Conversely," he adds, "it is a reasonable hypothesis that habitual physical activity of significant duration and intensity has physiological effects of a protective nature against premature clinical coronary heart disease."

Some investigators report that "graded" exercise helps restore cardiac patients to full physical activity.

A statistical study by the Health Insurance Plan of Greater New York, covering 55,000 men, showed those leading a physically active life had a two-to-three times better chance of surviving a heart attack than those leading a sedentary life.

After an extensive review of published information, Dr. Samuel M. Fox III of the U. S. Public Health Service heart disease control program said it was difficult to obtain conclusive proof that physical activity helps prevent or allay coronary heart disease.

The disease, he noted, is interwoven with many factors, including

family history, body build, smoking, emotional stress, blood pressure, weight and concurrent ailments.

The automation syndrome

For 22 years, Floyd Williams, 57, arose at the same time to catch the same bus to go to work at the same place.

But this morning was different. He didn't seem to know where he was. He shook his head hard, tried to think himself into the present. He would have gone back to sleep but his wife came in, threw back the bedclothes and pulled him to a sitting position on the bed.

"You seem to be crying all night in your sleep," she commented. "It's time you were going to work."

Williams didn't get to work that morning or for many months of mornings thereafter. He was suffering from a mental entity a physician calls "the automation syndrome."

"This type of syndrome is comparatively new but is being seen with increasing frequency because of manifestations of automation in industry," Dr. Barnard Teitel of Long Beach, Calif., explains.

It occurs when one's feelings of security are closely related to his feelings of having an identity. One's job is intimately concerned with a sense of identity.

If an employe is rigid and addicted to routine behavior, he will find it difficult to shift to another job. If forced, he may develop an emotional disorder, ranging from neurosis to a psychosis.

Williams was the third generation in his family to work for a petroleum company where he maintained a gas engine in the refinery. When he spoke of the company, it was with fondness, pride and loyalty.

For several months he had been talking about "pressures" at work. The plant was installing automation.

He noted many of his fellow employes were having increasing illness—strokes, heart attacks, peptic ulcers. One close friend committed suicide.

Several years before, Williams had been offered an advancement. He turned it down for fear it involved too much responsibility. He felt unable to learn a new job at that point in his life.

"The automation revolution is altering man's way of life as profoundly as the introduction of mechanical power into manufacturing," Dr. Teitel says in the *Archives of Psychiatry*, published by the American Medical Assn.

"Greater emotional flexibility on the part of the employe is required. Individuals with rigid, obsessive-compulsive personality will have in-

creasing difficulty in readjusting, leading to increasing problems of emotional illness."

Fluoride aids bones

Investigators at Harvard Medical School have found that osteoporosis, a disease in which there is a reduction in bone mass and bone fragility, can be retarded by drinking water containing generous concentrations of fluoride.

They studied two population groups in North Dakota. In one, the water was high in fluoride content and in the other it was low. Analysis of X rays of 1,015 men and women, ages 45 to 85, showed twice as many were judged to have decreased bone density and two to six times as many showed collapsed vertebrae in the low fluoride area compared with the high. This was especially true among women.

An unexpected finding of unusual interest was that fewer calcified aortas were found in men in the higher fluoride area, suggesting that fluorides might have a preventive role in hardening of the arteries by helping keep calcium deposited in the hard tissues of the body—bone and teeth.

Fluorides have proven their role in lessening tooth decay by 60 to 70 percent through water fluoridation.

The deadly bee

About 20 deaths a year are attributable to bee sting, says Dr. Terumasa Miyamoto of Northwestern University medical school. Another 25 or 30 deaths are caused by other stinging animals. The total is higher than deaths due to snake bite.

Honey bee hives may contain as many as 50,000 inhabitants and the worker bees will attack promptly if the colony is threatened. The hornet builds the large, gray, oval nest often seen hanging from the branches of trees and the wasp builds small, open-bottomed, comb-type nests. They contain as many as 10,000 wasps who pour out in droves at any threat. Nests of the yellow jackets, so called because of the yellow bands on the body, are just under the ground near old logs.

The human head and neck are the most frequent attack sites. Usually the reaction is local, with pain, redness and swelling at the site of the sting. The general bodily reactions following a single sting are believed due to an allergy.

Perfumes, hair spray, hair tonic, suntan lotion and many other cosmetics attract insects. Brightly colored clothes, black clothes and floppy clothing in which an insect might be caught should be avoided. They

are attracted by any sort of food, by outdoor cooking and dirty garbage cans. Repeated spraying of the cans and of the patio will tend to keep insects away.

"In the event of a sting, it should be remembered that a honey bee leaves its stinger in the skin after stinging," Dr. Miyamoto points out. "Since it takes two to three minutes for the venom sac to inject all the venom, instant removal of the stinger and sac will prevent many of the harmful effects of the venom. This can be done with one swift scrape of the finger nail. The sac should not be picked up between the thumb and the forefinger because this squeezes in more venom. The hornet, wasp and yellow jacket which do not lose their stingers should be brushed off promptly."

Annual checkups

Ninety percent of Americans would have annual checkups for cancer if urged to do so by their physicians. Thus, says Dr. Leonard W. Larson, past president of the American Cancer Society, the physician is the key person in preventing cancer.

One of the attitudes that must be changed, Dr. Larson says, is the belief by those who do not have checkups that doctors treat symptoms and do not conduct checkups.

"I call on every doctor in the land to demonstrate at every opportunity that checkups are necessary and important," he urges. "At the same time no physician, anywhere, must ever turn aside one who comes to him with a complaint about a persistent cough or what seems to him as persistent indigestion or any other warning signal of cancer . . ."

Babble back

Here's advice for parents: When baby babbles, babble back.

Infant babbling is important to language development, says Dr. Richard W. Olmsted, chairman of the department of pediatrics, University of Oregon. It can best be encouraged if parents echo the baby's sounds rather than introduce more sophisticated sounds.

Parents should use baby talk until the baby gives them the cue to switch to adult talk, at two.

Hearing hazard

Hunting is a hazard to hearing. The repeated blast of a shotgun fired from the right shoulder can cause significant loss of hearing in the right ear, Dr. G. Dekle Taylor of Jacksonville, Fla., reports. Sportsmen usually are unaware of any hearing loss until they begin missing the usual field sounds—the bay of a dog or the quack of a duck.

Hunters are also exposed to the blast from their companions' guns. Dr. Taylor advises protection of ears by cotton and wax plugs. Earmuffs are best of all but are uncomfortable in hot weather.

Backfire from Speeding Light

SOME months ago I wrote a "Please Explain" item on the subject of why matter cannot travel faster than the velocity of light in a vacuum. As matter went faster and faster, more and more of its added energy of motion went into mass rather than velocity, until at the velocity of light, *all* the additional energy went into mass and it could go no faster.

Letters have come in asking further questions. Some have asked "Why does the energy go into mass instead of velocity?" or "Why does light travel at 186,282 miles per second instead of another speed?"

I'm afraid that, as of now, the only possible answer to such questions is "Because that's the way the Universe is."

Some have asked, "In what way is mass increased?" That is easier. It is not by increasing the number of atoms. That stays the same. Each atom—indeed, each particle within the atom—increases in mass.

Some questioned whether we might not increase our resources by making matter move so fast that it would double its mass. Then we would have twice as much.

Not really. The increase in mass is not "real." It is a matter of measurement. Velocity only has meaning as a measurement relative to something else—to the person doing the measurement for instance. It is only the measuring that counts. It is impossible for you to *measure* matter going faster than light.

But suppose you grabbed on to the matter, which you had measured as having twice its normal mass, in order to use it for some purpose. If you travelled with it, then its velocity relative to you is zero and suddenly its mass is normal.

If you and a friend flashed by each other, at the speed of light you would measure his mass as very high and he would measure your mass as very high. Each would think his own mass was normal.

You might say, "But which has *really* increased in mass?" The answer is, "It depends on who is doing the measuring." There's no such thing as "really," everything is only as it is measured relative to something else by somebody. Hence the

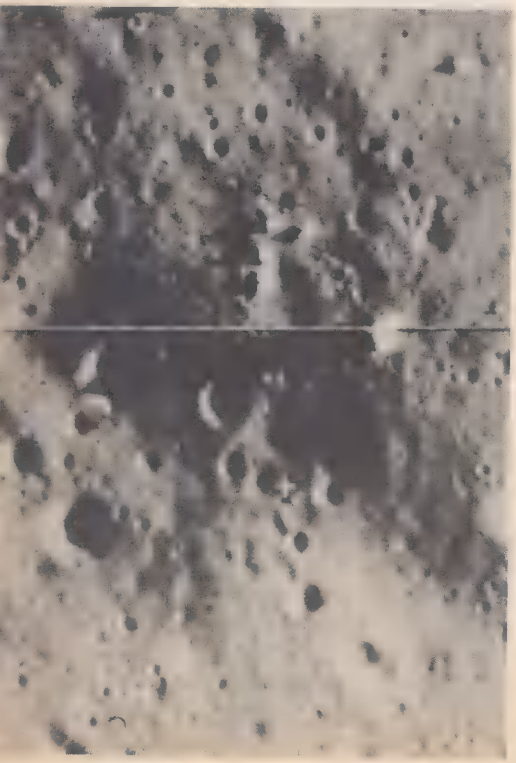
name, theory of "relativity."

You think you are standing heads up and that the Australians are standing heads down. But the Australians think they are head up and you heads down. Which view is "really" correct? Neither. There's no such thing as "really." It depends on where you are standing on Earth. All is relative.

Some have asked, "If mass goes up with velocity, then wouldn't it go down to zero if an object were standing absolutely still." There is no such thing as "absolutely still," however. There is only "relative rest." Something can be at rest relative to something else. When an object is at rest relative to the person doing the measurement, it has a certain minimum mass called "rest mass." Mass can't be less than that.

A high relative velocity doesn't merely increase the measured mass of an object. It also decreases the measured length of the object in the direction it is travelling and slows up the measured passage of time on that object.

And if you ask why, the answer is "Because that's the way the Universe is." —*Isaac Asimov*



I have seen a photo taken by one of our Lunar Orbiter vehicles, which shows what looks like artificially made spires on the moon's surface. What about this?

The photograph (shown at left) was widely reprinted, and it does show some very curious shadows. However, NASA does not believe that they come from any sort of artificial structure. Here is the official explanation of the picture:

The photo shows "lunar surface with large protuberance in cratered upland basin approximately at 150° 20′ E and 4° 30′ N. The photograph is made by the telephoto lens of Lunar Orbiter II's camera system. The white crosses in the photograph are reference marks used by scientists in photographic measurements. The reference mark lines represent about 25 feet on the lunar surface. The area shown is about 750 by 550 feet. Since the photo-

graph was taken shortly after local sunrise, the shadows point westward. The striking shadow casting protuberances shown are naturally occuring features on the lunar surface. The largest protuberance, located in the center of the photograph is about 50 feet wide at the base and about 40 to 75 feet high, based on the length of its shadow cast by the sun 11° above the horizon. Precise height measurements will be possible after ground slope measurements have been made."

The pyramids of Egypt have been explored many times. Why are scientists still looking for hidden chambers in some of them.

A number of pyramids, notably the famous Great Pyramid at Giza, have several interior chambers, but others, like the nearby pyramid of Chephren have only one known chamber. Some archaeologists suspect that there may be undisclosed chambers in them. Since the pyramids were built for the purpose of keeping the king's body and treasure safe from tomb robbers, the entrances to these chambers would undoubtedly be cleverly concealed, and may have escaped attention, even though the surface of the pyramid has been minutely examined many many times.

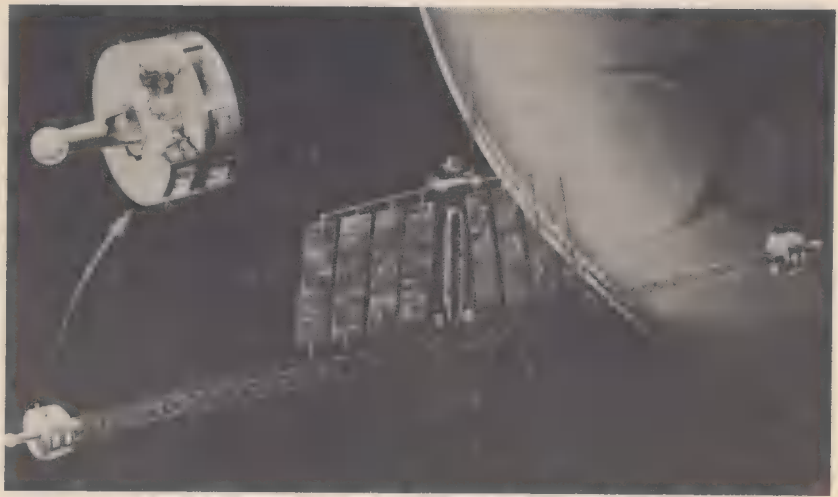
It is impractical just to drill right through the surface of the pyramid in the hopes that you will come upon a chamber. So recently the United Arab Republic signed an agreement with the United States to allow a team from the Atomic Energy Commission and the Smithsonian Institution to "X-ray" the Pyramid of Chephren.

Cosmic rays pass right through the great mass of the pyramid. If they pass through a hollow area the difference should be detectable with modern equipment, if it is properly placed.

The current project was conceived several years ago by Dr. Luis W. Alvarez of the University of California. He calculated that if a cosmic ray detector, called a spark chamber, is placed in the known chamber beneath the Chephren pyramid it would be ideally suited for detecting cosmic rays and recording their path through the pyramid.

If the plan works out, scientists will use it on other pyramids as well.

"We have enough questions. What we need now are a few answers."



Ernst Stuhlinger, in History of Rocketry and Space Travel

Lure of other worlds

History of Rocketry and Space Travel, by Wernher von Braun and Frederick T. Ordway III—Thomas Y. Crowell Co., N. Y. ($14.95).

"The history of rocketry and astronautics can, of course, never be completely told at any one time," according to a candid admission in the introduction of this remarkable book. Mssrs. von Braun and Ordway have, however, taken a seven league stride toward achieving the impossible goal.

This 244-page volume, illustrated with hundreds of fascinating pictures in color and black and white—everything from old prints to spectacular NASA photos—covers man's yen to explore the universe from 3000 B.C. to the present day. What isn't here isn't likely to be missed by most space fans. Many people may be introduced for the first time to David Russen's catapult (1703) that would fire men to the moon by giant spring in a sled-like affair; to Atterlay's space ship, lined with padded leather (1827); to E. E. Hale's "brick moon," first known proposal for a manned orbiting satellite (1870).

The book covers 1,000 years of rocketry development—from black powder Chinese festival rockets to our current giants. There was Charles Golightly's patented "steam rocket" flying machine that only got off the ground in satirical cartoons. The work of practical rocketeers—Goddard, Oberth, Valier and others, along with the latter day men who applied the knowledge occupies the final two thirds of this book. *—RFD*

The Life and Death of a Satellite. Alfred Bester. Little, Brown ($5.95).

The sad truth is that the ordinary guy finds America's important and expensive unmanned satellites program a big bore. As a result he doesn't bother to find out much about it. This state of affairs troubled the veteran science fiction writer Alfred Bester. "I realized," says Bester, after he had a particularly discouraging conversation with a friend, "that the average intelligent adult understands very little about the fascinating research conducted by our space program; in fact, he understands far less than his ten-year-old son."

Not that it is all the fault of the average guy, no indeed. Bester comments, "Space science has developed such a special vocabulary that the layman finds it impossible to follow. There are times when I suspect the scientists and engineers of deliberately fostering this language barrier."

Bester sets out to remedy this situation by presenting a lively account of why and how a satellite is launched. "The Life and Death of a Satellite" is not just a "hardware" account. Bester attempts to convey the feelings and ideas of the men behind the machines. It is a difficult task, but Bester has very nearly succeeded in pulling it off.

For Your Information; on Earth and Sky. Willy Ley. Doubleday. ($4.95).

For several years now, Willy Ley, one of the nation's top science popularizers has been writing a regular column for *Galaxy Science Fiction*, called "For Your Information." The column is a free-wheeling affair. Ley discusses matters of great scientific significance, but as often as not he uses his column to poke into some obscure, odd, but unfailingly interesting aspects of our universe. A number of the columns have been collected into the present volume. The best that can be said for them is that they are never boring, and that is a very good thing to say indeed.

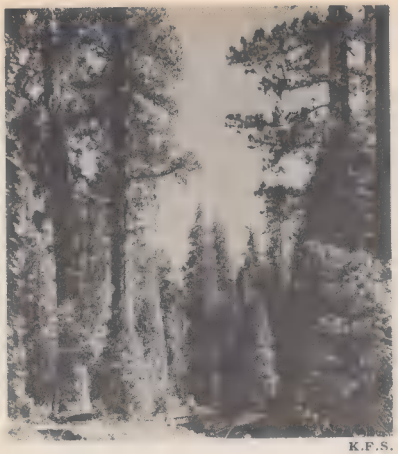
The Flight of the Unicorns. Anthony Shepherd. Abelard-Schuman ($5.00).

At one time accounts of the heroic exploits of big game hunters were common reading fare. But the world has changed drastically. The big game is gone, or almost so, and the heroes today are the men who are trying to preserve what little is left.

The Arabian oryx, one of the most beautiful creatures in the world, is one of the rarest. Driven to its last refuge in a desolate corner of the Arabian desert, the graceful creature (generally held to be the animal which inspired the unicorn legend) faced certain extinction.

A small group of dedicated men, however have saved them from oblivion by transferring a small number to a carefully tended colony at the Phoenix Zoo in Arizona.

Anthony Shepherd, one of the members of the expedition tells the story of the capture and transfer in "The Flight of the Unicorns."



K.F.S.

All about trees

by John and Molly Daugherty

1. The buds on a tree develop in the
   a. Spring
   b. Summer
   c. Fall

2. If you drive a heavy spike into a tree five feet above the ground, many years later you will find the spike
   a. More than five feet above the ground
   b. Still five feet above the ground
   c. Less than five feet above the ground

3. The number of tree species is largest in
   a. The Great Smoky Mountains
   b. Western Europe
   c. The taiga of Canada

4. The densest wood of these North American oaks is the
   a. White oak
   b. Black oak
   c. Live oak

5. Of these conifer trees, the only evergreen is the
   a. Baldcypress
   b. Pinyon pine
   c. Tamarack (larch)

6. The communications and power industries use a lot of the wood of the
   a. Black locust
   b. Laurel oak
   c. American elm

7. A bristlecone pine about 4,000 years old is the oldest living tree. It is found in the California White Mountains. A season's growth of needles on a bristlecone pine may last as long as
   a. 2-3 years
   b. 14-17 years
   c. 50-100 years

8. The wood of the tree important in textile-weaving machinery is the
   a. Beech
   b. Southern red oak
   c. Flowering dogwood

9. The pine growing farthest north in North America is the
   a. Eastern pine
   b. Jack pine
   c. Red (Norway) pine

10. The tree with bark that can't stretch is the
    a. American sycamore
    b. Sugar maple
    c. White ash

Answers:

1—b Summer. The buds develop fully in the growing season of summer. They lie dormant through fall and winter. In spring with the intake of water, buds usually expand rapidly, so many people think buds appear on the twigs in spring because that's when the budding shows.

2—b Still five feet above the ground. Increase in the height of a tree starts in growth tissues, which come from buds. Increase in girth of the trunk occurs from new layers of wood formed by the cambium layer just under the bark. The spike may be buried under expanding layers of wood.

3—a The Great Smoky Mountains. Its forest covers about 1,000 square miles and includes the Great Smoky Mountain National Park. There, more than 130 species live, whereas in all of western Europe there are only 85. The Smoky Mountains region has the last virgin timber of the original great forest of eastern U.S.

The taiga is a belt of forest cover in Canada north of the deciduous trees. It is limited to the conifers such as spruces, firs, and pines.

4—c Live oak. It has the density of about 60 pounds a cubic foot; the white oak, 48 pounds; the black, 43.

The white oak is the chief oak and covers a wide natural range in the eastern United States. The black oak covers a similar range. The live oak is in Florida, Texas, and along the lower Atlantic and Gulf coasts.

5—b Pinyon pine. It's found in the Southwest. Its needles stay as long as nine years on its branches, though some may begin to fall the fourth year.

The American baldcypress and the tamarack are the only deciduous conifers, they shed their leaves yearly.

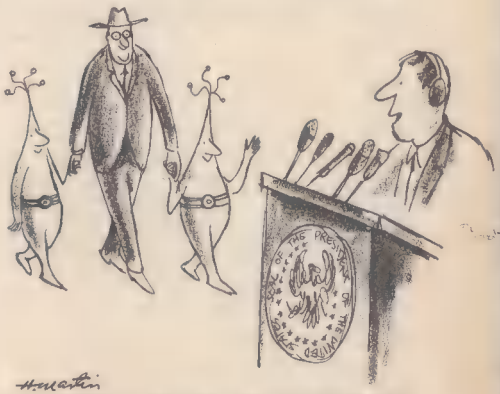
Conifers are cone-bearing trees. Evergreens always have leaves, though they continually lose some.

6—a Black locust. The wood is a favorite for making insulator pins for cross arms on power transmission and telephone lines. In one year the production of pins may run as high as 25,000,000.

Other uses include tree nails to peg ship timbers together, wagon wheel hubs and tool handles.

7—b 14-17 years. Its needles grow in clusters of five and are sturdy and deep green. Other pine needles may stay on the tree from two to nine years, the singleleaf pinyon pine keeps its needles from ten to twelve years.

The natural range of the bristlecone pine covers part of California, Nevada, Utah, Colorado, Arizona,



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and New Mexico at elevations of 8,000 to 11,000 feet.

8—c Flowering dogwood. The largest percent of dogwood cut for commercial use goes into shuttles for textile-weaving. The close-textured, smooth, hard wood shows only a slight wearing effect upon the thread. Spools and bobbin heads are also made of dogwood.

9—b Jack pine. The jack pine extends far northward in Mackenzie, Canada—less than 2° from the Arctic circle. Its natural range spreads about 2,500 miles east-west and 1,600 miles north-south. It has short grey-green needles with two to a cluster.

The tamarack or American larch grows even farther north, but it isn't a pine. It grows to the limit of tree growth near the arctic circle.

10—a American Sycamore. As the sycamore grows older, large thin plates of the bark peel off, revealing inner bark tinged with yellow, white, and green. When the trunk and limbs expand in growing, the bark peels in plate-like pieces. Apparently the outer bark can't expand.

The leaves of the American sycamore are the largest single-bladed leaves in our forests. The wood is tough and makes excellent chopping blocks.

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LETTERS TO SCIENCE DIGEST

Shocked!

I have always enjoyed your magazine, but was very shocked by the views of Dr. Robert S. Morison which you printed in the Jan. '67 issue. So he thinks "that the family is a poor source of disseminating knowledge essential to survival in a rapidly moving world, and that other agencies probably will be taking over the training of children at an earlier age." He fails to realize that knowledge is not the most important factor in our world today. Are we going to follow the Communists in sending our children to nurseries where they can be taught what the "state" decides they should know?

Many of our criminals say that

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they never felt loved, therefore try to get even with society. Would we not have more of this if we allowed all children to be put in institutions that took care of their physical needs, but not their emotional ones.

As for his prediction that we might "better the species by relying on artificial insemination for stronger progeny." Really sounds like something a man named Adolph Hitler once advocated, doesn't it?

I know that you are just reporting what people say, but consider the socialistic statement in another article in the same issue, "City Planning Today," where you advocate that the cities and their services should be supported by the National Treasury. Very utopian, but hardly practical, considering human nature, and all its faults.

Just couldn't help expressing my views and telling you that I hope you will stand for our democratic country and not advocate changing it for socialism, communism or the like.

MRS. JEREMY BUDD
East Peoria, Ill.

Science Digest isn't "advocating" anything. It is reporting Dr. Morison's views, which made the news, and it is our job to report the news. The reference to "utopian cities" was cited as an example of a possible extreme eventuality. —Ed.

Best tribute

I must say, in all sincerity, that I feel your write-up on the Apollo I tragedy (March, '67) was approached in a most commendable manner, and was by far the best tribute paid these fine men in any periodical, bar none! You probed the promising future rather than dwelling on the past.

Your article was short on words, but long on meaning. It seemed to point out the one very real, very important fact: that no matter what happens, even when we suffer a loss as great as the untimely deaths of Astronauts Grissom, White and Chaffee, the world moves on and we must progress with it!

HENRY STARKLE
West Hartford, Conn.

Misconception

Science Digest is designed to inform the layman of scientific progress. The layman, therefore, must be willing to change his false ideas, in order to learn from such a magazine. Your January '67 issue has a headline which accomplishes the exact opposite by giving false information. On page 34 there is the headline "Where Gravity Disappears." Now you must know that gravity never disappears or is non-existent anywhere. It can be counterbalanced via acceleration, but it is still there. When a person jumps off a building he becomes weightless, but see if you can convince him after he has crash-landed that gravity disappeared. You might think that this is a trivial point. However, it is this kind of error that causes people to misconstrue simple concepts.

LARRY GERSTMAN
Baldwin, N.Y.

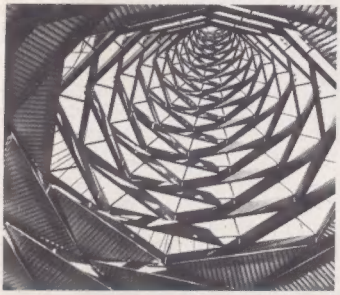
Technically Mr. Gerstman is correct. For the men involved, gravity does disappear. Actually it is the gravitational effect that disappears. —Ed.

Tree with a trauma

It looks as if this tree is covered with snow. But it isn't. It is covered with thick layers of spider webs. The tree is a Shilling tree, which grows in the uplands of India; this particular one grows about 6,000 feet above sea level near the village of Chandag, in the Kumaon Hills. Nobody knows exactly why spiders were so attracted to the Shilling tree which is not a common variety. However, the white bark of the tree emits a mellow odor which might attract spiders. The photographer was able to find plenty of insects that had been caught in the enormous web, but not a single spider. Birds seemed wise enough to avoid the tree altogether. Local villagers said that they had never seen the phenomenon before, but noted that the webs seemed extremely strong and had been able to withstand high winds and rainstorms.

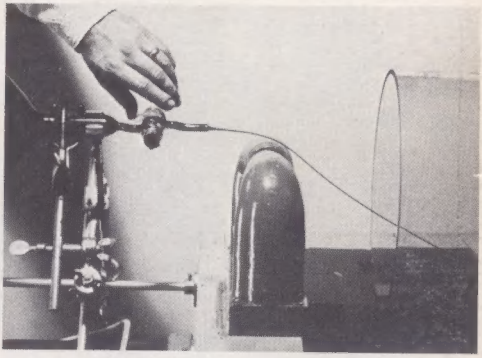
In this issue . . .

Beneath this soaring pagoda-like structure exhibits will explore the implications of the rapid trend towards urbanization. It's part of Expo '67, on page 21.



A few years ago laser engineers laughed at this scene from Goldfinger. Now they don't laugh so easily. Not that torture is the most practical use of a laser, but the promise of the miracle ray is really coming true. Story is on page 8.

Something like this may happen to you in an accident. To make steering wheels safer, auto manufacturers are using a linear impact device, one of the many things "New for People," page 24.



The stream of a newly developed magnetic liquid can be significantly deflected when exposed to an ordinary magnet. This seemingly esoteric discovery may have great use in the aerospace industry. See "New for Industry" p. 66.

If it's not a smoke ring, what is it? That's just one question in a fascinating astronomy quiz. See pages 48 and 49.

Bang! The trigger plant has just forceably pollinated another insect. This month's issue is filled with intriguing items like this. Trigger plant story is on page 42.

A spider injected with LSD will build a different kind of web than one that has had morphine. See story page 28.